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(54) Title: ENCODING AND DECODING TRANSFORMATION METHOD AND SYSTEM, DEVICE, AND COMPUTER READABLE MEDIUM

(54) 发明名称: 一种编码、解码变换方法、系统、设备及计算机可读介质

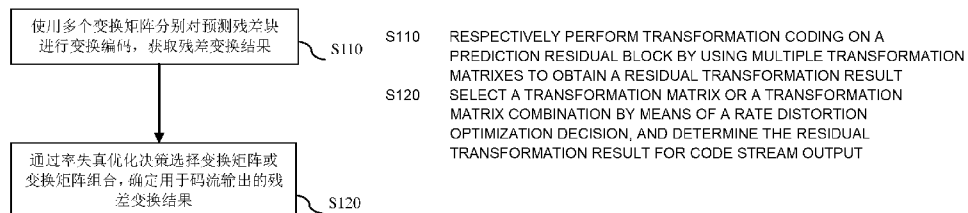


图 1

(57) Abstract: Disclosed are an encoding and decoding transformation method and system, a device, and a computer readable medium. The method of embodiments of the present application comprises: respectively performing transformation coding on a prediction residual block by using multiple transformation matrixes to obtain a residual transformation result; and on the basis of the residual transformation result, selecting, from the multiple transformation matrixes, a transformation matrix or a transformation matrix combination matched with the residual characteristic of the prediction residual block by means of a rate distortion optimization decision, and determining the residual transformation result for code stream output. Compared with the prior art, in the method provided by the embodiments of the present invention, the transformation matrixes better matched with the residual characteristics are adopted to perform residual transformation, so that the expression effect of a residual signal is improved, and the coding efficiency of the residual block is improved.

(57) 摘要: 本申请公开了一种编码、解码变换方法、系统、设备及计算机可读介质。本申请实施例的方法包括: 使用多个变换矩阵分别对预测残差块进行变换编码, 获取残差变换结果; 基于所述残差变换结果, 通过率失真优化决策从所述多个变换矩阵中选择与所述预测残差块的残差特性匹配的变换矩阵或变换矩阵组合, 确定用于码流输出的残差变换结果。相较于现有技术, 本发明实施例的方法采用与残差特性更为匹配的变换矩阵进行残差变换, 从而提高了残差信号的表达效果, 提升了残差块的编码效率。

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根据细则4.17的声明:

— 发明人资格(细则4.17(iv))

本国际公布:

— 包括国际检索报告(条约第21条(3))。

## 一种编码、解码变换方法、系统、设备及计算机可读介质

本申请要求享有 2019 年 2 月 1 日提交的名称为“一种编码、解码变换方法、系统、设备及计算机可读介质”的中国专利申请 CN201910105653.9 的优先权，其全部内容通过引用并入本文中。

### 技术领域

本说明书涉及计算机技术领域，尤其涉及一种编码、解码变换方法、系统、设备及计算机可读介质。

### 背景技术

在数字多媒体技术应用领域之中，在传输视频文件时，为了加快传输速度，通常会对视频文件进行压缩编码传输。

大量统计表明，同一幅图像的邻近像素之间有着相关性，或者说这些像素值相似，邻近像素之间发生突变或“很不相似”概率很小。而且同帧图像中邻近行之间对应位置的像素之间也有较强的相关性。由于相关性的存在，邻近像素值之差很小，差值信号的方差也是很小的。而由于图像的误差信号的方差与图像信号本身的方差相比较小，其量化器的动态范围也可以缩小，相应的量化分层数目就可以减少，这样每个像素的编码比特数也显著下降，而且不至于使视频质量明显降低，这就最终可以实现视频压缩编码的目的。

因此，在现有技术中，利用上述性质进行视频压缩编码传输，取像素预测值与实际值之间的残差作为传输的信号。进一步的，在上述视频压缩编码过程中，在完成残差预测后会对残差进行编码变换，生成残差变换结果，从而进一步去除视频序列中的冗余信息，实现残差信号的高效表达，最终在码流中输出的是残差变换结果。然而，在现有的视频编码标准中支持的变换矩阵有限，变

换矩阵无法适应各种残差的特性，这就导致残差变换后的残差变换结果并不能按预期实现残差信号的高效表达。

### 发明内容

5 有鉴于此，本说明书实施例提供了一种编码、解码变换方法、系统、设备及计算机可读介质，用于改善现有技术中应用于残差变换的变换矩阵适应性不高的问题。

本说明书实施例采用下述技术方案：

本说明书实施例提供一种编码变换方法，所述方法包括：

10 使用多个变换矩阵分别对预测残差块进行变换编码，获取残差变换结果；  
基于所述残差变换结果，通过率失真优化决策从所述多个变换矩阵中选择与所述预测残差块的残差特性匹配的变换矩阵或变换矩阵组合，确定用于码流输出的残差变换结果。

在一实施例中，使用多个变换矩阵分别对预测残差块进行变换编码，其中，  
15 使用两个不同的变换矩阵分别对预测残差块进行变换编码。

在一实施例中，所述变换矩阵包括基于矩阵乘法的变换矩阵。

在一实施例中，所述变换矩阵包括基于离散余弦变换 II 型的二维整数变换矩阵。

在一实施例中，使用多个变换矩阵分别对预测残差块进行变换编码，包括：  
20 根据所述预测残差块的来源选取进行变换编码的变换矩阵，其中，所述预测残差块的来源包括帧内预测以及帧间预测。

在一实施例中，通过率失真优化决策从所述多个变换矩阵中选择与所述预测残差块的残差特性匹配的变换矩阵或变换矩阵组合，其中，针对行变换以及列变换进行分别决策。

25 在一实施例中，通过率失真优化决策从所述多个变换矩阵中选择与所述预测残差块的残差特性匹配的变换矩阵或变换矩阵组合，其中，将被选择的变换

矩阵或变换矩阵组合对应的变换选择标记增添到码流中。

在一实施例中，将被选择的变换矩阵或变换矩阵组合对应的变换选择标记增添到码流中，其中，根据各种变换矩阵和/或变换矩阵组合的被选择概率确定变换选择标识的表达形式。

- 5        在一实施例中，根据各种变换矩阵和/或变换矩阵组合的被选择概率确定变换选择标识的表达形式，其中，针对帧内预测残差：

行变换以及列变换均选择基于离散余弦变换 II 型的二维整数变换矩阵对应的变换选择标识为 000；

- 10       行变换选择基于矩阵乘法的变换矩阵、列变换选择基于离散余弦变换 II 型的二维整数变换矩阵对应的变换选择标识为 01；

行变换选择基于离散余弦变换 II 型的二维整数变换矩阵、列变换选择基于矩阵乘法的变换矩阵对应的变换选择标识为 001；

行变换以及列变换均选择基于矩阵乘法的变换矩阵对应的变换选择标识为 1。

- 15       在一实施例中，根据各种变换矩阵和/或变换矩阵组合的被选择概率确定变换选择标识的表达形式，其中，针对帧间预测残差：

行变换以及列变换均选择基于离散余弦变换 II 型的二维整数变换矩阵对应的变换选择标识为 1；

- 20       行变换选择基于矩阵乘法的变换矩阵、列变换选择基于离散余弦变换 II 型的二维整数变换矩阵对应的变换选择标识为 01；

行变换选择基于离散余弦变换 II 型的二维整数变换矩阵、列变换选择基于矩阵乘法的变换矩阵对应的变换选择标识为 000；

行变换以及列变换均选择基于矩阵乘法的变换矩阵对应的变换选择标识为 001。

- 25       本申请还提出了一种解码变换方法，所述方法包括：

确定码流中残差变换结果对应的变换矩阵或变换矩阵组合；

使用所述变换矩阵或所述变换矩阵组合对所述残差变换结果进行反变换。

在一实施例中，所述变换矩阵包括基于矩阵乘法的变换矩阵。

在一实施例中，其特征在于，所述变换矩阵包括基于离散余弦变换 II 型的二维整数变换矩阵。

5        在一实施例中，其特征在于，确定码流中残差变换结果对应的变换矩阵或变换矩阵组合，包括：

确定所述预测残差块的来源，基于所述预测残差块的来源确定码流中残差变换结果对应的变换矩阵或变换矩阵组合，其中，所述预测残差块的来源包括帧内预测以及帧间预测。

10       在一实施例中，其特征在于，确定码流中残差变换结果对应的变换矩阵或变换矩阵组合，包括：

读取所述码流中的变换选择标识，根据所述变换选择标识确定码流中残差变换结果对应的变换矩阵或变换矩阵组合。

本申请还提出了一种编码变换系统，包括：

15       编码变换模块，其配置为使用多个变换矩阵分别对预测残差块进行变换编码，获取残差变换结果；

决策模块，其配置为基于所述残差变换结果，通过率失真优化决策从所述多个变换矩阵中选择与所述预测残差块的残差特性匹配的变换矩阵或变换矩阵组合，确定用于码流输出的残差变换结果。

20       本申请还提出了一种解码变换系统，包括：

变换矩阵确认模块，其配置为确定码流中残差变换结果对应的变换矩阵或变换矩阵组合；

解码变换模块，其配置为使用所述变换矩阵或所述变换矩阵组合对所述残差变换结果进行反变换。

25       本申请还提出了一种计算机可读介质，其上存储有计算机可读指令，所述计算机可读指令可被处理器执行以实现本说明书实施例所述的方法。

本申请还提出了一种用于在用户设备端进行信息处理的设备，该设备包括用于存储计算机程序指令的存储器和用于执行程序指令的处理器，其中，当该计算机程序指令被该处理器执行时，触发该设备执行本说明书实施例所述的方法。

- 5       本说明书实施例采用的上述至少一个技术方案能够达到以下有益效果：相较于现有技术，本发明实施例的方法采用与残差特性更为匹配的变换矩阵进行残差变换，从而提高了残差信号的表达效果，提升了残差块的编码效率。

### 附图说明

- 10       此处所说明的附图用来提供对本申请的进一步理解，构成本申请的一部分，本申请的示意性实施例及其说明用于解释本申请，并不构成对本申请的不当限定。在附图中：

图 1 以及图 2 为根据本说明书实施例的编码变换方法执行流程图；

图 3 以及图 4 为根据本说明书实施例的解码变换方法执行流程图；

- 15       图 5 为根据本说明书一实施例的编码变换系统结构框图；

图 6 为根据本说明书一实施例的解码变换系统结构框图。

### 具体实施方式

- 为使本申请的目的、技术方案和优点更加清楚，下面将结合本申请具体实  
20       施例及相应的附图对本申请技术方案进行清楚、完整地描述。显然，所描述的实施例仅是本申请一部分实施例，而不是全部的实施例。基于本申请中的实施例，本领域普通技术人员在没有做出创造性劳动前提下所获得的所有其他实施例，都属于本申请保护的范围。

- 25       在现有技术中，在进行视频压缩编码传输时，，取像素预测值与实际值之间的残差作为传输的信号。进一步的，在上述视频压缩编码过程中，在完成残差预测后会对残差进行编码变换，生成残差变换结果，从而进一步去除视频序

列中的冗余信息，实现残差信号的高效表达，最终在码流中输出的是残差变换结果。然而，在现有的视频编码标准中支持的变换矩阵有限，变换矩阵无法适应各种残差的特性，这就导致残差变换后的残差变换结果并不能按预期实现残差信号的高效表达。

5       针对上述问题，本说明书实施例提出了一种编码变换方法。在本说明书实施例的方法中，采用多个不同的变换矩阵对残差块进行变换计算，然后选取其中最优的计算结果。这样，就有效地避免了单一变换矩阵不能适应所有残差的特性的问题，将变换矩阵与残差块特性的优化匹配体现到了最终用于码流输出的变换系数中，从而提高了残差信号的表达效果，提升了残差块的编码效率。

10       以下结合附图，详细说明本说明书各实施例提供的技术方案。如图 1 所示，在一实施例中，方法包括以下步骤：

S110，使用多个变换矩阵分别对预测残差块进行变换编码，获取残差变换结果；

15       S120，基于获取到的残差变换结果，通过率失真优化决策从进行变换编码的多个变换矩阵中选择与预测残差块的残差特性匹配的变换矩阵或变换矩阵组合，确定用于码流输出的残差变换结果。

具体的，在一实施例中，在步骤 S110 中，对预测残差块进行变换编码后生成变换系数。残差变换结果就包含分别使用每一个变换矩阵对预测残差块进行变换编码而生成的变换系数。

20       进一步的，在一实施例中，在步骤 S120 中，率失真优化决策指的是基于率失真优化（Rate distortion optimization,RDO）对对应不同的变换矩阵或变换矩阵组合的残差变换结果进行对比，从而确定最优的残差变换结果对应的变换矩阵或变换矩阵组合。

25       进一步的，在一实施例中，在步骤 S120 中，在通过率失真优化决策从多个变换矩阵中选择与预测残差块的残差特性匹配的变换矩阵或变换矩阵组合时，将被选择的变换矩阵或变换矩阵组合对应的变换选择标记增添到码流中，

从而使得解码端可以根据码流中的变换选择标记确定当前编码使用的变换矩阵。

进一步的，在一实施例中，在步骤 S120 中，在通过率失真优化决策从多个变换矩阵中选择与预测残差块的残差特性匹配的变换矩阵或变换矩阵组合时，针对行变换以及列变换进行分别决策。具体的，基于行变换结果以及列变换结果将使用多个变换矩阵分别对预测残差块进行变换编码所获取残差变换结果分为两部分。分别基于这两部分的残差变换结果，通过率失真优化决策从多个变换矩阵中选择与预测残差块的残差特性匹配的变换矩阵，最终选择出进行行变换的变换矩阵以及进行列变换的变换矩阵。根据具体的应用场景，最终选择出的进行行变换的变换矩阵以及进行列变换的变换矩阵可以相同，也可以不同。

进一步的，在步骤 S110 中，针对编码单元或是编码单元下的变换单元（Transform Unit,TU），使用多个变换矩阵分别对预测残差块进行变换编码。具体的，在一实施例中，对编码单元（Coding Unit,CU）或是编码单元下的预测单元（Prediction Unit,PU）进行残差预测，获取预测残差块。

进一步的，在一实施例中，为了进一步提高变换矩阵与残差特性间的适应度，根据预测残差块的来源选取进行变换编码的变换矩阵，其中，预测残差块的来源包括帧内预测以及帧间预测。

具体的，在一实施例中，对编码单元（Coding Unit,CU）或是编码单元下的预测单元（Prediction Unit,PU）进行帧内或是帧间预测，获取预测残差块。在步骤 S110 中，在使用多个变换矩阵分别对预测残差块进行变换编码时，确定预测残差块对应的是帧内或是帧间预测，基于确定结果选取对应的变换矩阵。

具体的，在一实施例中，帧内预测残差和帧间预测残差使用不同的变换矩阵。例如，在一应用场景中，预先配置的变换矩阵为矩阵 A1、矩阵 A2、矩阵 A3、矩阵 B1、矩阵 B2、矩阵 B3。其中，矩阵 A1、矩阵 A2、矩阵 A3 用于帧

内预测；矩阵 B1、矩阵 B2、矩阵 B3 用于帧间预测。在进行残差变换时，首先判断当前的残差块是帧内预测获取的还是帧间预测获取的。如果是通过帧内预测获取的残差块，则利用矩阵 A1、矩阵 A2、矩阵 A3 分别进行残差变换，获取三个不同的变换系数；如果是通过帧间预测获取的残差块，则利用矩阵 B1、矩阵 B2、矩阵 B3 分别进行残差变换，获取三个不同的变换系数。

进一步的，在一实施例中，帧内预测残差和帧间预测残差使用相同的变换矩阵。例如，在一应用场景中，预先配置的变换矩阵为矩阵 A1、矩阵 A2、矩阵 A3。在进行残差变换时，无论当前的残差块是帧内预测获取的还是帧间预测获取的。均利用矩阵 A1、矩阵 A2、矩阵 A3 分别进行残差变换，获取三个不同的变换系数。

进一步的，在一实施例中，部分变换矩阵即可以用于帧内预测残差也可以用于帧间预测残差。部分变换矩阵只能用于帧内预测残差或者帧间预测残差。例如，在一应用场景中，预先配置的变换矩阵为矩阵 A1、矩阵 A2、矩阵 A3、矩阵 B2、矩阵 B3。其中，矩阵 A1 用于帧内预测以及帧间预测；矩阵 A2、矩阵 A3 用于帧内预测；矩阵 B2、矩阵 B3 用于帧间预测。在进行残差变换时，首先判断当前的残差块是帧内预测获取的还是帧间预测获取的。如果是通过帧内预测获取的残差块，则利用矩阵 A1、矩阵 A2、矩阵 A3 分别进行残差变换，获取三个不同的变换系数；如果是通过帧间预测获取的残差块，则利用矩阵 A1、矩阵 B2、矩阵 B3 分别进行残差变换，获取三个不同的变换系数。

进一步的，在一实施例中，为了降低编码变换的计算数据量，采用双变换矩阵的形式。在使用多个变换矩阵分别对预测残差块进行变换编码的过程中，分别使用第一变换矩阵以及第二变换矩阵对预测残差块进行变换编码，从而获取第一变换系数以及第二变换系数。在通过率失真优化决策从获取到的多个变换系数中选择用于码流输出的变换系数的过程中，通过率失真优化决策选择采用第一变换系数或者第二变换系数。

例如，在一应用场景中，预先配置的变换矩阵为矩阵 A1、矩阵 A2。在进

行残差变换时，利用矩阵 A1、矩阵 A2 分别进行残差变换，获取二个不同的变换系数；在通过率失真优化决策从获取到的多个变换系数中选择用于码流输出的变换系数的过程中，选择二个变换系数中的一个。

进一步的，在一实施例中，进行残差变换的变换矩阵包括基于矩阵乘法的变换（Matrix Multiplication Transform, MMT）矩阵。具体的，在一实施例中，  
5 针对 MMT 矩阵，通过矩阵乘法来实现对预测残差块进行变换编码。

具体的，在一实施例中，使用 MMT 矩阵进行残差变换的变换操作如下：

$$S = M \cdot R \cdot M^T \quad (1)。$$

公式 1 中，R 为预测残差块，M 为基于矩阵乘法的变换矩阵（MMT），而 S  
10 为变换后的变换系数。由于矩阵乘法可通过并行计算方法进行加速，所以在使用 MMT 矩阵进行残差变换时，进行加速和优化的操作难度大大降低。

进一步的，在一实施例中，进行残差变换的变换矩阵包括基于离散余弦变换 II 型（DCT-II）的二维整数变换矩阵。

具体的，在一实施例中，使用基于矩阵乘法的变换（Matrix Multiplication  
15 Transform, MMT）矩阵以及基于离散余弦变换 II 型（DCT-II）的二维整数变换矩阵进行残差变换。

具体的，如图 2 所示，在一实施例中，方法包括以下步骤：

S210，对当前编码单元或是编码单元下的预测单元进行帧内或帧间预测，  
得到预测残差块；

20 S220，对当前编码单元或是编码单元下的变换单元进行变换编码，其中，使用 DCT 变换矩阵对预测残差块进行变换编码，获取残差变换结果；

S230，对当前编码单元或是编码单元下的变换单元进行变换编码，其中，使用 MMT 变换矩阵对预测残差块进行变换编码，获取残差变换结果；

S240，综合步骤 220 以及步骤 230 获取的残差变换结果，分别针对行变换  
25 以及列变换进行率失真优化决策，选择最终用于码流输出的残差变换结果所对应的变换矩阵或是变换矩阵组合（确认最终用于码流输出的残差变换结果是否

采用 MMT 变换矩阵)；

S250, 将最终选择的用于码流输出的残差变换结果所对应的变换矩阵或是变换矩阵组合所对应的变换选择标识增添到码流中输出。

在上述流程中, 针对某一编码单元的帧内或帧间预测的预测残差块, 最终  
5 码流输出的残差变换结果所对应的变换矩阵包括以下 4 种情况:

(1) DCT+DCT, 最终码流输出的残差变换结果的行变换采用 DCT 变换矩阵, 列变换也采用 DCT 变换矩阵;

(2) MMT+DCT, 最终码流输出的残差变换结果的行变换采用 MMT 变换矩阵, 列变换采用 DCT 变换矩阵;

10 (3) DCT+ MMT, 最终码流输出的残差变换结果的行变换采用 DCT 变换矩阵, 列变换采用 MMT 变换矩阵;

(4) MMT + MMT, 最终码流输出的残差变换结果的行变换采用 MMT 变换矩阵, 列变换也采用 MMT 变换矩阵。

具体的, 在一实施例中, 变换选择标识采用二进制标识。

15 进一步的, 在一实施例中, 根据各种变换矩阵和/或变换矩阵组合的被选择概率确定变换选择标识的表达形式。具体的, 如果发生的概率高就使用较短的标识, 从而达到节省码率的目的。

具体的, 在一实施例中, 对于帧内预测残差, 上述四种变换矩阵分别标识为: DCT+DCT 对应的变换选择标识为 000, MMT+DCT 对应的变换选择标识  
20 为 01, DCT+ MMT 对应的变换选择标识为 001, MMT + MMT 对应的变换选择标识为 1。

具体的, 在一实施例中, 针对帧间预测残差, 上述 4 种变换矩阵分别标识为, DCT+DCT 对应的变换选择标识为 1, MMT+DCT 对应的变换选择标识为 01, DCT+ MMT 对应的变换选择标识为 000, MMT + MMT 对应的变换选择标识  
25 为 001。

进一步的, 在一实施例中, 针对 MMT 矩阵, 帧内预测残差和帧间预测残

差使用不同的 MMT 矩阵。

进一步的，在一实施例中，针对用于进行残差变换的 MMT 矩阵，变换矩阵尺寸包括  $4 \times 4, 8 \times 8, 16 \times 16, 32 \times 32, 64 \times 64$ 。

进一步的，在一实施例中，针对帧间预测残差不使用  $64 \times 64$  尺寸的 MMT，  
5 也就是针对帧间预测残差的 MMT 变换尺寸最大为  $32 \times 32$ 。

进一步的，在一实施例中，为了避免进行浮点计算，用于进行残差变换的 MMT 矩阵被转化为整数。

进一步的，在一实施例中，用于进行残差变换的 MMT 矩阵包括对应不同精度需求的 MMT 矩阵。具体的，在一实施例中，用于进行残差变换的 MMT  
10 矩阵包括第一精度 MMT 矩阵以及第二精度 MMT 矩阵，其中，第一精度 MMT 矩阵的精度低于第二精度 MMT 矩阵。

具体的，在一实施例中，用于帧内预测残差的第一精度 MMT 矩阵如下所示。变换矩阵尺寸  $4 \times 4$ ：

15 
$$\begin{aligned} &\{38, 60, 74, 76, \}, \\ &\{77, 66, -13, -77, \}, \\ &\{-82, 40, 68, -58, \}, \\ &\{49, -82, 77, -35, \}。 \end{aligned}$$

变换矩阵尺寸  $8 \times 8$ ：

20 
$$\begin{aligned} &\{26, 40, 53, 65, 73, 78, 79, 75, \}, \\ &\{-60, -83, -81, -58, -15, 32, 68, 81, \}, \\ &\{79, 75, 11, -62, -87, -47, 30, 80, \}, \\ &\{84, 28, -71, -70, 30, 90, 18, -75, \}, \\ &\{84, -35, -82, 46, 71, -59, -58, 61, \}, \\ &\{70, -79, -1, 80, -73, -14, 83, -52, \}, \\ &\{-50, 86, -76, 29, 33, -79, 85, -40, \}, \\ &\{27, -55, 75, -85, 85, -74, 55, -23, \}。 \end{aligned}$$

变换矩阵尺寸  $16 \times 16$ ：

30 
$$\begin{aligned} &\{18, 26, 33, 40, 47, 54, 60, 66, 71, 75, 79, 81, 82, 81, 79, 76, \}, \\ &\{-48, -65, -78, -86, -87, -82, -70, -52, -30, -7, 17, 39, 59, 72, 79, 78, \}, \\ &\{67, 84, 83, 67, 36, -3, -40, -70, -86, -85, -65, -32, 8, 47, 74, 85, \}, \\ &\{82, 88, 58, 7, -47, -83, -85, -53, 0, 52, 83, 82, 46, -8, -58, -83, \}, \\ &\{88, 70, 7, -61, -89, -60, 7, 69, 86, 50, -22, -80, -83, -34, 36, 82, \}, \\ &\{86, 45, -39, -88, -54, 33, 88, 59, -26, -87, -64, 22, 85, 68, -13, -81, \}, \\ &\{82, 16, -71, -72, 20, 92, 39, -64, -83, 2, 86, 57, -47, -90, -14, 77, \}, \\ &\{85, -14, -90, -20, 83, 49, -64, -72, 40, 85, -15, -90, -10, 87, 36, -70, \}, \\ &\{88, -51, -84, 51, 77, -53, -70, 55, 66, -57, -61, 58, 59, -63, -56, 62, \}, \\ &\{68, -64, -41, 80, 4, -85, 36, 72, -69, -45, 91, 7, -95, 35, 77, -61, \}, \\ &\{60, -80, 1, 84, -71, -30, 96, -46, -59, 91, -19, -70, 78, 5, -76, 47, \}, \\ &\{53, -87, 44, 40, -90, 65, 12, -81, 84, -13, -67, 87, -37, -45, 87, -46, \}, \\ &\{45, -88, 78, -21, -46, 84, -79, 32, 31, -78, 85, -46, -21, 79, -90, 41, \}, \end{aligned}$$

{37, -80, 96, -80, 41, 8, -52, 78, -78, 53, -12, -35, 74, -91, 79, -33, },  
 {-24, 56, -77, 87, -84, 72, -51, 22, 13, -45, 71, -86, 89, -80, 60, -24, },  
 {10, -25, 39, -53, 65, -78, 88, -94, 94, -89, 81, -69, 55, -41, 26, -10, }。

变换矩阵尺寸  $32 \times 32$ :

5 {16, 20, 24, 28, 32, 35, 38, 42, 45, 49, 52, 55, 58, 62, 64, 67, 70, 72, 74, 76, 78, 79, 80, 81, 82, 82, 82, 81, 8  
 1, 79, 78, 76, },  
 {-44, -54, -62, -70, -76, -81, -84, -86, -87, -86, -83, -79, -73, -65, -57, -47, -36, -25, -13, -2, 10, 22,  
 34, 44, 54, 62, 69, 74, 78, 79, 79, 77, },  
 {-62, -74, -82, -87, -86, -81, -72, -60, -44, -26, -6, 14, 34, 51, 66, 78, 85, 89, 87, 81, 70, 56, 38, 19, -1,  
 10 -20, -39, -55, -68, -77, -81, -80, },  
 {-73, -84, -86, -81, -66, -46, -21, 8, 35, 59, 77, 88, 89, 81, 63, 39, 11, -18, -44, -66, -81, -89, -86, -75,  
 -56, -32, -5, 24, 49, 68, 79, 83, },  
 {-78, -86, -79, -58, -28, 8, 41, 68, 85, 88, 75, 50, 15, -23, -55, -78, -88, -83, -63, -32, 5, 42, 70, 87, 90,  
 77, 50, 16, -22, -55, -78, -87, },  
 15 {-87, -89, -67, -28, 17, 58, 83, 89, 72, 38, -6, -49, -79, -90, -77, -43, 2, 45, 77, 88, 76, 44, 1, -42, -74, -  
 87, -79, -51, -8, 36, 69, 86, },  
 {-89, -81, -44, 8, 58, 88, 86, 54, 2, -48, -81, -87, -61, -11, 42, 80, 88, 66, 19, -34, -74, -88, -70, -27, 24,  
 68, 89, 78, 38, -15, -61, -85, },  
 {-89, -71, -19, 43, 84, 84, 46, -13, -67, -89, -69, -17, 44, 84, 84, 43, -20, -73, -90, -65, -9, 51, 85, 79, 3  
 20 7, -22, -73, -92, -64, -8, 51, 87, },  
 {-91, -59, 10, 72, 90, 53, -13, -72, -88, -51, 16, 73, 86, 48, -20, -75, -86, -46, 26, 83, 86, 38, -33, -82, -  
 81, -34, 38, 87, 80, 27, -39, -84, },  
 {-93, -46, 36, 92, 77, 3, -69, -89, -43, 34, 81, 70, 11, -60, -87, -47, 29, 84, 75, 8, -64, -90, -48, 29, 84, 7  
 8, 11, -66, -89, -47, 28, 80, },  
 25 {-81, -31, 50, 87, 43, -38, -85, -57, 23, 84, 68, -9, -80, -80, -3, 78, 85, 14, -67, -88, -31, 58, 93, 44, -45  
 , -93, -56, 32, 89, 66, -15, -81, },  
 {-74, -14, 63, 72, 9, -70, -78, 1, 80, 79, -8, -93, -71, 25, 89, 63, -35, -95, -48, 46, 91, 38, -59, -89, -24,  
 64, 85, 15, -74, -81, 0, 79, },  
 {79, 2, -73, -64, 23, 89, 41, -59, -87, -11, 81, 75, -27, -96, -39, 64, 84, -3, -81, -57, 38, 89, 20, -73, -73  
 30 , 14, 89, 51, -57, -91, -12, 81, },  
 {99, -16, -105, -46, 78, 89, -26, -102, -33, 81, 76, -39, -90, -12, 77, 55, -45, -79, 3, 79, 40, -57, -70, 15  
 , 77, 32, -61, -67, 28, 78, 19, -64, },  
 {-77, 29, 85, 3, -81, -35, 64, 64, -44, -82, 19, 93, 6, -91, -33, 75, 64, -54, -82, 24, 91, 14, -88, -50, 69, 7  
 9, -38, -93, 3, 91, 33, -72, },  
 35 {69, -38, -75, 24, 76, -8, -74, -11, 76, 27, -76, -44, 75, 57, -70, -66, 63, 78, -52, -90, 36, 99, -18, -104,  
 2, 98, 14, -89, -25, 82, 43, -69, },  
 {89, -68, -84, 67, 78, -64, -76, 62, 74, -61, -70, 56, 68, -56, -67, 58, 63, -60, -59, 60, 56, -63, -55, 63, 5  
 4, -61, -53, 62, 50, -62, -50, 58, },  
 {-72, 69, 55, -79, -32, 79, 19, -80, -4, 78, -15, -75, 32, 72, -54, -60, 70, 44, -79, -30, 86, 12, -92, 9, 94,  
 40 -26, -95, 44, 87, -59, -79, 72, },  
 {60, -72, -28, 85, -10, -77, 34, 66, -59, -46, 76, 25, -91, 9, 89, -48, -66, 72, 37, -84, -4, 90, -37, -79, 75  
 , 46, -98, 1, 97, -42, -78, 63, },  
 {61, -84, -9, 94, -49, -68, 86, 23, -97, 29, 78, -70, -34, 86, -18, -72, 59, 41, -82, -2, 89, -54, -54, 90, -5  
 , -84, 63, 37, -88, 20, 69, -49, },  
 45 {-55, 87, -18, -78, 82, 21, -98, 49, 55, -87, 15, 72, -68, -23, 84, -41, -54, 83, -5, -82, 69, 30, -94, 47, 56  
 , -91, 21, 70, -82, -1, 78, -49, },  
 {55, -101, 51, 52, -107, 53, 52, -99, 43, 57, -90, 19, 64, -72, 6, 62, -58, -14, 73, -51, -24, 80, -60, -29, 9  
 7, -62, -33, 90, -64, -23, 84, -47, },  
 {-27, 51, -27, -26, 57, -37, -23, 74, -58, -21, 85, -73, -3, 82, -96, 25, 69, -103, 52, 47, -107, 73, 17, -90  
 50 , 95, -19, -71, 98, -48, -39, 86, -45, },  
 {36, -77, 62, 0, -64, 86, -43, -39, 92, -72, -2, 78, -101, 44, 54, -112, 81, 13, -93, 98, -29, -54, 89, -63, 5  
 , 48, -68, 50, -5, -49, 67, -31, },  
 {-48, 104, -99, 34, 47, -99, 90, -27, -49, 89, -73, 15, 46, -78, 64, -15, -36, 69, -68, 26, 31, -67, 71, -42,  
 -12, 65, -89, 67, 1, -76, 98, -45, },  
 55 {-37, 84, -96, 65, -7, -49, 79, -75, 36, 24, -72, 87, -66, 14, 45, -79, 77, -40, -20, 73, -93, 74, -31, -24, 6  
 9, -85, 66, -14, -51, 95, -95, 41, },  
 {31, -75, 96, -88, 55, -2, -53, 88, -94, 66, -15, -42, 84, -95, 77, -34, -21, 66, -89, 82, -47, -2, 45, -72, 7  
 9, -61, 24, 20, -59, 80, -70, 28, },

{-23,57,-81,92,-88,65,-27,-16,51,-72,74,-54,19,22,-62,90,-97,80,-46,4,37,-66,75,-65,37,1,-39,71,-96,105,-86,34,},  
 {22,-56,81,-97,103,-96,76,-45,9,26,-59,83,-88,78,-60,35,-2,-33,61,-79,84,-79,65,-40,10,21,-48,67,-79,79,-60,23,},  
 5 {-3,10,-22,37,-54,75,-93,102,-106,104,-93,74,-54,35,-17,4,3,-5,0,13,-30,49,-69,87,-98,100,-94,84,-72,55,-35,12,},  
 {9,-23,32,-37,39,-40,36,-26,12,5,-26,49,-71,90,-108,120,-128,128,-120,105,-87,69,-48,25,-3,-14,27,-35,41,-41,33,-13,},  
 10 {-9,22,-34,44,-54,65,-74,80,-85,87,-84,77,-68,56,-44,29,-12,-6,24,-43,60,-74,85,-93,98,-97,89,-79,68,-55,37,-14,}。

变换矩阵尺寸  $64 \times 64$ :

{17,19,21,23,25,26,28,30,32,33,35,37,39,41,43,45,46,48,50,51,53,54,56,57,59,61,62,63,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,80,80,81,81,81,81,81,81,80,80,79,79,78,77,76,76,75,},  
 15 {-44,-49,-54,-59,-63,-67,-70,-73,-75,-78,-80,-82,-83,-84,-85,-85,-85,-85,-84,-83,-81,-79,-77,-75,-72,-69,-65,-61,-57,-53,-48,-43,-38,-32,-27,-21,-15,-10,-4,2,8,14,20,26,31,37,42,47,52,56,60,65,69,72,75,77,79,81,81,82,82,81,80,78,},  
 {65,72,77,82,85,87,88,88,87,85,81,77,72,66,59,52,44,35,26,17,8,-1,-10,-20,-30,-38,-47,-55,-62,-68,-74,-78,-82,-85,-86,-87,-86,-85,-81,-78,-73,-67,-61,-53,-45,-36,-26,-16,-6,4,13,23,33,42,51,58,65,71,76,79,81,83,83,82,},  
 20 {71,79,84,87,87,85,81,75,67,58,47,34,21,8,-5,-18,-32,-44,-54,-64,-72,-79,-83,-87,-88,-86,-82,-76,-68,-58,-47,-34,-20,-6,9,23,36,48,59,69,77,84,88,90,90,87,82,75,66,55,43,30,16,1,-14,-28,-42,-54,-64,-73,-79,-83,-85,-85,},  
 {75,82,84,84,79,72,61,47,32,15,-2,-18,-35,-50,-64,-74,-82,-87,-88,-85,-79,-71,-59,-45,-27,-9,11,29,46,62,74,84,89,91,89,83,74,62,47,30,10,-8,-27,-45,-62,-76,-85,-91,-92,-90,-83,-72,-58,-42,-25,-6,13,30,46,59,70,78,82,83,},  
 25 {80,87,87,82,71,56,37,16,-7,-30,-51,-68,-81,-89,-91,-88,-80,-66,-48,-28,-6,17,38,58,76,88,92,91,84,72,56,36,12,-11,-32,-51,-67,-79,-86,-87,-84,-75,-60,-41,-19,5,28,49,66,79,87,89,84,73,58,40,19,-2,-23,-43,-60,-73,-80,-82,},  
 30 {83,88,84,72,54,32,6,-21,-46,-68,-83,-91,-90,-83,-68,-46,-19,9,35,58,75,87,91,86,74,54,28,0,-27,-52,-70,-83,-88,-85,-74,-58,-36,-10,17,43,66,81,89,89,80,64,40,14,-13,-40,-62,-79,-88,-88,-81,-66,-46,-23,1,27,50,69,80,85,},  
 {80,83,74,56,31,2,-27,-53,-73,-84,-86,-78,-62,-38,-8,23,52,75,88,91,83,65,40,8,-25,-54,-76,-89,-91,-81,-61,-35,-2,29,58,80,91,91,79,57,28,-4,-36,-64,-83,-92,-88,-74,-51,-21,12,43,68,85,91,85,69,46,18,-13,-41,-63,-77,-83,},  
 35 {87,85,70,44,10,-25,-54,-75,-85,-84,-69,-44,-12,21,50,73,85,84,69,44,12,-22,-53,-77,-88,-85,-67,-39,-3,31,59,79,86,81,63,35,1,-34,-64,-84,-90,-84,-63,-31,7,45,74,90,92,79,53,18,-22,-57,-81,-93,-91,-75,-47,-13,24,58,82,93,},  
 {96,92,69,33,-10,-51,-80,-95,-92,-72,-38,2,41,74,92,91,72,40,2,-36,-68,-86,-87,-72,-42,-4,36,69,88,88,70,38,-3,-43,-72,-87,-84,-64,-33,5,43,71,85,82,63,30,-8,-44,-71,-84,-79,-58,-25,12,47,74,85,81,61,30,-9,-46,-74,-89,},  
 40 {95,85,51,7,-38,-73,-91,-88,-64,-25,20,59,84,92,77,42,-5,-50,-82,-93,-82,-53,-12,33,71,91,89,66,24,-23,-62,-86,-89,-73,-40,4,48,79,90,81,51,10,-35,-71,-88,-83,-56,-16,26,61,81,82,61,26,-14,-51,-74,-82,-71,-44,-6,35,66,85,},  
 45 {-86,-72,-36,8,49,75,81,64,28,-15,-53,-77,-79,-59,-21,26,63,81,76,50,11,-32,-67,-83,-78,-49,-2,45,79,88,71,35,-13,-57,-84,-87,-67,-26,22,66,91,91,60,13,-39,-81,-100,-86,-44,9,60,92,96,73,29,-23,-67,-94,-95,-69,-21,31,73,96,},  
 {-96,-75,-29,25,71,95,86,47,-8,-58,-85,-87,-61,-13,39,78,89,73,31,-20,-62,-85,-79,-48,0,50,83,86,56,7,-42,-77,-85,-67,-27,23,65,89,81,44,-8,-58,-87,-86,-52,0,52,86,85,57,10,-41,-78,-90,-69,-25,28,72,91,82,42,-14,-63,-89,},  
 50 {-82,-60,-14,36,73,83,60,14,-40,-77,-84,-60,-14,39,80,92,65,13,-43,-83,-89,-59,-8,44,78,84,57,6,-50,-87,-87,-50,10,64,89,81,41,-16,-66,-92,-81,-38,23,75,95,75,24,-38,-84,-94,-65,-9,48,87,88,55,1,-54,-87,-85,-51,3,56,87,},  
 {-92,-61,-1,59,91,81,37,-24,-75,-94,-71,-15,47,90,92,50,-14,-69,-92,-76,-25,38,80,87,58,5,-57,-96,-86,-37,27,78,92,67,10,-52,-85,-80,-39,20,68,83,60,11,-44,-78,-80,-42,21,73,89,63,6,-53,-84,-75,-33,24,70,84,59,9,-45,-82,},  
 55 {-91,-54,10,66,87,63,10,-47,-80,-73,-29,29,70,81,49,-12,-68,-88,-59,-1,55,80,64,22,-32,-73,-79,-44,20,73,87,57,-7,-68,-90,-68,-9,59,91,75,19,-46,-86,-81,-33,35,90,90,41,-27,-85,-95,-52,16,75,97,66,3,-64,-102,-83,-20,49,97,},

{-92,-51,22,83,94,49,-24,-82,-90,-51,18,78,93,57,-11,-75,-100,-62,14,78,93,57,-10,-70,-90,-56,12,72,90,53,-12,-72,-89,-57,6,71,91,56,-10,-71,-90,-53,16,73,88,47,-24,-78,-81,-38,32,81,77,29,-35,-77,-74,-28,34,78,73,24,-33,-70,},

5 {-94,-41,37,88,81,20,-50,-90,-71,-4,62,89,57,-10,-71,-83,-41,26,75,79,30,-40,-84,-72,-16,47,90,72,-4,-69,-90,-53,24,79,81,34,-34,-85,-77,-20,50,87,63,2,-62,-87,-52,20,81,89,31,-48,-92,-76,-8,66,96,62,-15,-81,-92,-42,33,85,},

{-102,-37,57,106,75,-13,-87,-99,-37,50,94,75,8,-69,-98,-57,30,98,91,14,-70,-102,-57,26,85,84,22,-60,-94,-55,21,80,76,22,-45,-86,-58,18,69,67,21,-35,-64,-50,-5,51,73,36,-31,-75,-62,-1,61,79,41,-29,-81,-77,-12,63,87,47,-25,-75,},

10 {-73,-16,47,73,36,-30,-66,-52,3,58,67,28,-36,-83,-56,19,84,80,7,-72,-95,-45,45,100,73,-9,-97,-101,-4,84,99,34,-62,-102,-58,31,90,76,4,-63,-81,-36,33,70,63,6,-69,-81,-23,52,87,51,-27,-85,-77,-9,73,96,41,-48,-100,-68,21,90,},

{-70,-20,49,76,36,-31,-74,-55,15,75,67,-4,-73,-79,-8,76,89,17,-71,-101,-41,61,109,60,-47,-108,-66,34,101,72,-16,-85,-77,-9,68,90,27,-56,-87,-46,39,89,57,-23,-87,-74,12,85,7

15 5,3,-71,-80,-17,61,82,30,-50,-82,-44,32,85,60,-14,-77,},

{-69,-11,58,71,18,-49,-79,-38,43,91,54,-40,-93,-58,33,96,58,-40,-95,-59,39,104,62,-44,-106,-60,56,110,35,-63,-96,-35,69,100,24,-71,-92,-27,59,91,39,-53,-97,-43,54,98,41,-54,-88,-39,43,82,39,-40,-75,-41,27,72,45,-21,-59,-49,6,56,},

{-9,-13,10,23,19,-8,-46,-27,25,56,34,-41,-68,-22,44,72,12,-64,-53,9,53,54,-22,-66,-31,26,72,33,-64,-71,-7,67,85,-9,-96,-71,18,103,84,-37,-111,-79,33,134,71,-67,-117,-57,69,125,36,-77,-107,-32,78,106,16,-79,-92,-16,89,88,-5,-82,},

20 {137,-7,-128,-110,26,140,92,-49,-137,-84,66,133,61,-68,-126,-40,91,105,6,-99,-91,33,103,52,-52,-92,-16,69,52,-8,-54,-44,36,68,10,-56,-62,11,71,34,-27,-54,-26,36,43,5,-28,-37,0,40,21,-10,-28,-17,15,29,4,-13,-18,-10,18,18,-3,-15,},

25 {-62,9,64,45,-27,-73,-28,48,74,12,-76,-70,28,101,38,-84,-89,30,105,39,-83,-94,21,105,54,-67,-107,-1,106,71,-46,-110,-33,85,92,-25,-100,-45,61,94,5,-86,-61,31,71,35,-42,-69,-16,58,62,-7,-67,-46,22,67,43,-33,-74,-28,47,79,12,-71,},

{-66,11,75,41,-48,-75,-7,69,58,-26,-78,-27,60,65,-23,-74,-15,64,45,-42,-67,8,75,36,-58,-70,20,76,22,-50,-55,2,63,54,-31,-98,-27,101,82,-52,-116,-30,102,105,-45,-126,-29,90,85,-24,-93,-41,60,86,-4,-83,-62,30,90,47,-59,-97,-16,89,},

30 {-78,23,89,33,-70,-80,23,94,40,-72,-90,25,105,34,-78,-85,39,99,5,-92,-53,65,85,-21,-93,-21,74,57,-40,-75,-5,78,48,-53,-83,8,98,33,-74,-66,35,87,8,-98,-37,80,60,-35,-78,-13,72,55,-40,-82,-14,77,67,-27,-86,-35,55,75,9,-67,},

{92,-35,-103,-19,88,65,-48,-93,3,100,37,-82,-69,45,84,-5,-86,-28,77,57,-52,-80,20,92,8,-79,-31,54,51,-33,-69,8,82,25,-73,-68,52,93,-12,-96,-43,69,88,-24,-103,-25,91,62,-51,-89,4,91,45,-63,-79,9,84,43,-59,-71,22,70,16,-50,},

35 {-56,31,60,-7,-56,-19,41,39,-22,-53,-1,60,26,-50,-50,29,71,-3,-80,-25,76,64,-69,-88,51,96,-30,-99,12,96,20,-97,-54,91,78,-77,-89,57,91,-25,-95,-12,89,53,-76,-83,64,88,-29,-96,-10,92,49,-64,-74,17,79,39,-59,-84,14,106,40,-91,},

{77,-45,-85,10,84,31,-73,-71,54,97,-31,-106,2,107,19,-103,-32,105,42,-103,-61,99,80,-88,-97,65,111,-40,-115,13,119,19,-119,-49,101,69,-77,-71,53,63,-36,-52,24,48,-16,-46,8,48,-4,-51,1,53,3,-48,-14,39,21,-20,-24,10,22,-16,-23,25,},

40 {47,-27,-55,12,59,3,-56,-19,50,35,-45,-40,35,35,-27,-31,31,29,-37,-33,42,44,-46,-57,48,65,-51,-72,53,80,-42,-88,18,98,0,-105,-6,101,15,-95,-27,86,47,-74,-63,61,82,-55,-96,40,110,-13,-118,-27,113,68,-90,-100,47,121,1,-125,-50,101,},

45 {84,-61,-92,43,97,-14,-98,-14,99,29,-93,-43,79,54,-68,-61,62,63,-52,-67,49,61,-43,-57,38,48,-35,-39,41,33,-41,-32,38,32,-39,-31,44,23,-39,-21,39,26,-42,-45,57,54,-73,-52,76,65,-70,-92,58,113,-36,-125,13,126,12,-122,-36,115,62,-95,},

{-107,98,102,-92,-107,85,115,-81,-117,77,112,-67,-109,63,100,-62,-91,61,80,-63,-66,71,48,-71,-39,67,29,-62,-16,56,5,-46,1,40,-1,-44,4,51,0,-58,-4,59,9,-66,-4,71,-11,-64,11,62,0,-64,-18,68,32,-64,-42,55,47,-55,-42,53,34,-41,},

50 {65,-72,-47,75,34,-75,-27,72,21,-71,-10,72,0,-81,13,91,-33,-88,44,86,-63,-78,85,58,-108,-32,125,3,-123,19,118,-31,-111,45,92,-57,-63,58,46,-52,-48,52,52,-54,-57,66,51,-74,-37,68,36,-60,-40,56,42,-53,-45,50,51,-54,-55,58,59,-62,},

55 {-59,73,27,-78,0,72,-12,-65,23,57,-32,-53,39,52,-54,-40,73,22,-82,-5,90,-30,-80,59,62,-83,-39,101,11,-105,8,106,-27,-105,55,84,-79,-43,73,24,-66,-22,67,30,-88,-17,116,-22,-110,39,93,-41,-80,43,75,-48,-74,48,78,-52,-75,61,72,-70,},

{-60,72,38,-80,-19,79,5,-76,12,75,-36,-69,61,46,-79,-5,74,-17,-76,37,75,-73,-46,99,-4,-89,48,58,-85,-17,95,-6,-107,41,93,-74,-54,88,18,-89,6,83,-26,-75,39,78,-68,-58,86,35,-91,-11,86,-6,-85,18,88,-28,-90,41,84,-52,-71,61,},

60

{63,-88,-17,94,-18,-85,37,76,-59,-58,83,23,-83,8,67,-34,-40,48,17,-63,15,68,-60,-39,83,-4,-79,44,49,-58,-28,66,6,-85,48,74,-98,-26,108,-21,-94,47,74,-54,-66,72,51,-100,-10,103,-35,-85,69,59,-87,-37,100,7,-102,24,88,-44,-75,61,},

5 {-64,90,14,-91,27,68,-50,-41,63,11,-67,18,62,-47,-37,61,3,-55,20,48,-50,-21,65,-10,-73,55,43,-78,1,68,-32,-49,57,16,-65,28,50,-62,-28,89,-18,-82,58,60,-94,-15,104,-36,-88,82,50,-110,0,118,-55,-99,98,59,-123,-4,121,-47,-94,73,},

{56,-88,2,90,-49,-68,82,32,-97,16,81,-52,-48,72,11,-78,30,64,-61,-38,84,-14,-73,66,21,-78,44,41,-83,12,79,-49,-50,80,-11,-79,72,48,-111,10,108,-68,-68,102,5,-98,60,57,-94,-9,97,-37,-74,79,26,-94,29,69,-65,-24,71,-19,-45,31,},

10 {43,-73,11,72,-64,-32,84,-20,-67,59,30,-74,10,63,-40,-44,68,9,-75,26,63,-68,-10,72,-55,-22,81,-53,-37,82,-14,-76,61,42,-100,30,83,-102,-9,122,-76,-77,125,-10,-103,79,27,-85,35,57,-71,-17,88,-43,-62,92,0,-94,58,53,-86,3,77,-48,},

{-48,87,-23,-75,78,29,-94,30,67,-74,-5,79,-58,-41,83,-13,-73,55,48,-83,2,81,-67,-17,79,-61,-18,78,-57,-26,75,-24,-56,62,4,-70,56,43,-94,19,76,-68,-17,78,-52,-34,93,-58,-43,15 101,-48,-67,107,-9,-103,85,37,-110,45,73,-97,5,79,-50,},

{49,-82,22,61,-79,3,89,-75,-32,88,-36,-40,53,2,-47,21,46,-60,-6,76,-68,-18,101,-76,-42,110,-70,-33,120,-89,-44,125,-76,-41,109,-72,-27,102,-77,-20,82,-45,-32,52,-7,-37,33,4,-43,31,36,-73,26,63,-93,15,88,-93,-3,88,-82,-8,81,-48,},

20 {-40,94,-69,-27,83,-50,-5,32,-22,-11,5,40,-23,-55,77,-15,-63,97,-43,-68,113,-57,-16,67,-79,33,21,-58,86,-51,-45,98,-72,7,72,-100,47,23,-73,101,-45,-77,123,-53,-43,109,-105,9,92,-105,50,40,-103,61,27,-71,69,-14,-60,63,-11,-35,55,-29,},

{-30,63,-36,-39,86,-46,-45,87,-36,-45,70,-24,-37,48,0,-40,18,30,-39,-8,58,-56,-9,91,-99,-9,132,-135,10,126,-136,12,116,-142,55,74,-137,93,18,-111,95,17,-101,73,9,-54,51,-20,-15,27,-14,-9,23,-2,-24,5,29,-29,-6,38,-32,-15,52,-29,},

25 {10,-20,12,10,-36,37,5,-53,51,-1,-45,52,-19,-32,55,-27,-14,35,-25,-2,19,-12,-5,11,10,-32,20,26,-62,37,35,-80,53,29,-87,80,-25,-61,104,-41,-68,102,-27,-81,113,-40,-74,125,-58,-70,138,-77,-53,136,-96,-37,135,-98,-35,126,-96,-19,101,-58,},

{46,-88,54,30,-79,27,62,-80,5,87,-97,-12,129,-108,-31,145,-124,-16,143,-138,14,111,-135,52,57,-105,79,-18,-42,72,-47,-11,59,-71,35,20,-51,50,-29,-8,45,-46,10,30,-48,32,7,-42,53,-30,-15,52,-47,1,39,-46,26,5,-29,35,-11,-29,45,-21,},

30 {-41,86,-60,-26,97,-80,-9,93,-96,14,82,-104,27,76,-101,24,73,-97,29,69,-114,67,33,-104,96,-22,-60,93,-71,6,58,-69,38,5,-38,40,-21,7,-1,-12,28,-31,14,24,-61,52,-3,-49,82,-58,-16,80,-88,35,43,-92,76,-2,-79,103,-45,-56,108,-54,},

{-50,115,-103,14,86,-115,44,69,-119,67,32,-99,79,13,-96,97,-23,-61,89,-46,-27,73,-66,24,24,-46,39,-19,-1,21,-36,36,-19,-10,34,-39,31,-17,-12,50,-62,29,23,-66,69,-18,-60,107,-84,-5,94,-111,48,48,-108,94,-24,-57,97,-73,2,67,-83,36,},

35 {30,-73,74,-23,-48,93,-75,-4,84,-103,50,38,-92,78,-14,-57,87,-56,-6,54,-64,46,-15,-27,62,-63,32,12,-55,71,-47,-3,51,-80,68,-16,-42,84,-87,40,34,-87,82,-15,-66,102,-80,18,58,-104,84,-9,-63,90,-74,27,30,-79,96,-62,-12,90,-117,55,},

40 {-43,112,-135,84,12,-100,130,-75,-27,113,-133,74,28,-107,108,-44,-34,95,-110,65,3,-52,72,-66,37,9,-57,90,-86,43,21,-73,85,-53,-5,58,-86,76,-33,-21,51,-44,6,34,-48,36,-7,-19,25,-11,-5,10,-10,15,-25,30,-17,-19,51,-48,2,65,-92,44,},

{24,-61,74,-54,14,34,-74,81,-49,-11,69,-97,79,-15,-59,106,-109,58,21,-90,117,-93,38,30,-92,122,-102,39,36,-96,115,-83,18,50,-91,96,-70,27,24,-67,74,-40,-6,44,-59,40,-7,-23,45 42,-50,38,-7,-28,52,-55,25,27,-67,73,-38,-24,74,-78,33,},

{-35,90,-116,102,-51,-10,51,-64,50,-10,-35,68,-80,69,-40,-1,39,-56,46,-11,-35,73,-92,83,-52,6,41,-69,72,-43,-12,67,-104,114,-93,44,17,-65,82,-67,19,49,-97,103,-73,13,48,-78,69,-25,-36,87,-103,79,-35,-13,49,-58,40,5,-55,92,-92,39,},

50 {-27,71,-97,95,-66,21,26,-60,70,-50,7,43,-79,87,-65,25,17,-49,53,-30,-4,37,-60,69,-68,56,-32,4,25,-50,58,-42,11,30,-68,100,-117,98,-44,-22,74,-96,78,-24,-38,87,-112,104,-64,5,52,-88,93,-66,12,52,-98,109,-86,33,28,-71,76,-32,},

{9,-29,54,-73,80,-73,54,-26,-2,19,-20,-1,36,-69,87,-84,67,-45,20,3,-13,6,10,-35,60,-73,76,-75,71,-57,30,2,-28,34,-24,-1,39,-86,126,-136,113,-61,-3,52,-72,57,-15,-39,88,-119,126,-105,58,1,-47,63,-47,8,42,-89,114,-111,80,-29,},

55 {20,-48,53,-30,-16,71,-115,135,-129,99,-56,8,31,-47,36,2,-53,96,-121,124,-109,86,-59,27,2,-15,11,2,-23,55,-86,103,-104,93,-78,60,-39,18,-3,0,-9,27,-51,74,-90,92,-80,59,-33,9,5,-7,-4,26,-49,69,-85,83,-66,47,-29,12,2,-3,},

{-24,64,-98,120,-117,83,-29,-27,70,-92,88,-62,19,32,-74,99,-103,78,-34,-11,47,-70,76,-64,36,5,-40,62,-81,89,-74,42,-1,-38,63,-77,80,-66,42,-9,-29,65,-90,91,-70,33,5,-32,53,60 -62,53,-25,-12,51,-77,81,-65,38,-5,-35,70,-92,85,-35,},

{17, -41, 57, -64, 59, -42, 16, 17, -52, 81, -101, 103, -84, 46, -2, -36, 62, -69, 61, -36, 0, 38, -75, 103, -120, 123, -107, 79, -45, 6, 33, -58, 65, -61, 46, -26, 2, 30, -64, 90, -106, 105, -86, 49, -13, -16, 41, -59, 64, -51, 22, 13, -49, 80, -96, 91, -68, 32, 8, -44, 72, -86, 73, -29, },  
 {-19, 50, -75, 91, -98, 91, -70, 38, -1, -34, 67, -94, 103, -94, 78, -49, 8, 29, -56, 76, -81, 73, -59, 35, -4, -25, 51, -71, 87, -93, 79, -50, 18, 12, -36, 57, -75, 84, -86, 71, -42, 8, 35, -77, 97, -97, 90, -79, 58, -23, -13, 38, -55, 60, -53, 35, -8, -24, 56, -79, 91, -88, 65, -24, },  
 {14, -42, 66, -82, 92, -95, 88, -69, 45, -15, -19, 57, -89, 107, -112, 106, -91, 68, -37, 6, 22, -49, 69, -77, 77, -64, 43, -22, -3, 32, -62, 81, -93, 104, -107, 101, -92, 78, -60, 36, -7, -24, 54, -74, 79, -72, 61, -47, 25, 2, -26, 44, -59, 67, -69, 58, -38, 12, 15, -42, 58, -57, 43, -16, },  
 {5, -14, 24, -34, 43, -52, 60, -62, 59, -55, 47, -34, 17, 1, -16, 27, -35, 44, -43, 35, -26, 14, 3, -20, 36, -51, 60, -65, 71, -75, 68, -53, 35, -16, 1, 10, -26, 53, -84, 104, -117, 118, -102, 71, -33, -3, 39, -72, 98, -114, 118, -110, 91, -66, 32, 12, -53, 83, -102, 112, -115, 105, -78, 29, },  
 {-11, 28, -44, 58, -72, 84, -90, 89, -82, 69, -49, 24, 5, -34, 61, -86, 113, -136, 147, -143, 133, -123, 111, -90, 66, -42, 18, 5, -27, 46, -58, 62, -63, 63, -60, 58, -56, 51, -46, 37, -25, 11, 4, -17, 30, -40, 49, -58, 59, -53, 45, -34, 19, -4, -13, 30, -44, 53, -55, 47, -40, 37, -29, 11, },  
 {4, -11, 21, -33, 47, -60, 73, -85, 94, -102, 110, -115, 110, -98, 82, -62, 45, -30, 12, 10, -30, 49, -68, 84, -95, 101, -106, 111, -117, 120, -112, 93, -73, 52, -33, 21, -9, -6, 17, -29, 41, -51, 56, -58, 59, -58, 55, -52, 49, -40, 28, -15, 3, 7, -18, 32, -45, 50, -49, 49, -49, 44, -32, 13, },  
 {-5, 13, -22, 32, -44, 55, -64, 71, -76, 80, -82, 84, -84, 80, -76, 70, -63, 61, -58, 51, -45, 39, -35, 34, -29, 20, -15, 12, -8, 2, 8, -19, 32, -43, 50, -55, 62, -69, 75, -82, 95, -107, 111, -111, 111, -111, 112, -114, 111, -99, 85, -67, 45, -26, 9, 9, -27, 40, -47, 50, -48, 44, -34, 13, },  
 {2, -7, 11, -13, 15, -16, 16, -16, 17, -19, 22, -23, 23, -23, 20, -17, 18, -18, 17, -20, 24, -24, 23, -27, 32, -38, 45, -51, 57, -64, 68, -65, 64, -63, 58, -51, 46, -44, 45, -47, 50, -47, 41, -29, 15, 0, -16, 32, -52, 72, -93, 115, -135, 149, -156, 156, -153, 142, -123, 101, -79, 58, -37, 13, }。

具体的，在一实施例中，用于帧内预测残差的第二精度 MMT 矩阵如下所示。变换矩阵尺寸  $4 \times 4$ ：

{151, 241, 297, 305, },  
 {306, 265, -53, -309, },  
 {-327, 161, 274, -233, },  
 {197, -328, 310, -140, }。

变换矩阵尺寸  $8 \times 8$ ：

{103, 161, 212, 258, 293, 314, 318, 301, },  
 {-240, -330, -325, -230, -60, 128, 272, 324, },  
 {316, 299, 46, -246, -348, -188, 119, 319, },  
 {338, 111, -283, -281, 120, 359, 71, -300, },  
 {336, -140, -329, 183, 286, -235, -231, 246, },  
 {278, -317, -5, 321, -293, -56, 334, -207, },  
 {-199, 344, -306, 116, 132, -315, 342, -160, },  
 {108, -221, 299, -339, 338, -296, 220, -92, }。

变换矩阵尺寸  $16 \times 16$ ：

{73, 103, 132, 161, 189, 216, 240, 263, 284, 301, 315, 324, 327, 325, 317, 303, },  
 {-190, -260, -310, -342, -347, -327, -280, -210, -122, -28, 68, 158, 234, 289, 316, 313, },  
 {270, 335, 333, 267, 144, -10, -160, -279, -343, -339, -261, -128, 34, 188, 297, 340, },  
 {330, 350, 233, 29, -186, -330, -339, -211, 0, 207, 332, 327, 182, -33, -231, -333, },  
 {350, 282, 28, -244, -354, -240, 27, 275, 346, 199, -87, -319, -332, -135, 145, 330, },  
 {345, 181, -157, -354, -216, 133, 353, 237, -103, -349, -257, 87, 339, 273, -50, -322, },  
 {327, 65, -282, -288, 82, 367, 156, -256, -332, 10, 343, 229, -187, -360, -55, 308, },  
 {338, -56, -362, -79, 330, 198, -255, -287, 160, 342, -59, -361, -41, 348, 144, -281, },  
 {350, -202, -337, 206, 308, -213, -279, 219, 263, -227, -245, 230, 236, -251, -223, 249, },  
 {271, -255, -164, 322, 18, -342, 143, 288, -274, -178, 364, 27, -381, 140, 309, -244, },  
 {239, -320, 2, 338, -284, -119, 385, -186, -234, 364, -76, -282, 312, 20, -304, 188, },  
 {210, -349, 175, 162, -361, 261, 46, -325, 337, -50, -267, 350, -150, -179, 350, -182, },

{180, -352, 311, -83, -183, 336, -314, 130, 123, -312, 340, -185, -83, 318, -361, 163, },  
 {149, -321, 382, -320, 166, 32, -210, 311, -313, 214, -48, -140, 297, -366, 316, -133, },  
 {-96, 224, -308, 347, -338, 286, -203, 86, 51, -181, 283, -342, 356, -321, 241, -97, },  
 {39, -98, 157, -212, 262, -311, 354, -376, 376, -357, 323, -276, 221, -163, 104, -39, }。

## 5 变换矩阵尺寸 $32 \times 32$ :

{65, 81, 96, 111, 126, 140, 153, 167, 181, 195, 208, 221, 234, 246, 258, 268, 278, 287, 295, 303, 310, 316,  
 320, 324, 326, 327, 327, 325, 322, 317, 311, 302, },  
 {-175, -215, -249, -280, -305, -324, -338, -345, -347, -343, -333, -316, -292, -262, -226, -187, -145,  
 -100, -53, -6, 42, 89, 134, 177, 216, 250, 277, 298, 311, 318, 316, 307, },  
 10 {-249, -298, -330, -346, -344, -325, -290, -239, -175, -103, -25, 55, 134, 206, 265, 311, 341, 354, 347,  
 322, 279, 222, 154, 78, -3, -82, -155, -220, -273, -309, -324, -321, },  
 {-290, -336, -346, -323, -265, -184, -83, 30, 141, 237, 310, 351, 355, 322, 253, 158, 45, -70, -177, -266,  
 -326, -355, -345, -299, -223, -128, -18, 95, 197, 273, 318, 332, },  
 {-313, -344, -315, -234, -110, 32, 164, 272, 338, 351, 300, 199, 62, -91, -222, -314, -353, -333, -253, -  
 130, 20, 166, 279, 349, 359, 307, 202, 62, -89, -221, -311, -349, },  
 15 {-349, -356, -268, -113, 69, 230, 332, 355, 289, 153, -25, -195, -315, -359, -308, -173, 8, 182, 306, 353,  
 303, 176, 4, -168, -295, -349, -318, -206, -33, 144, 277, 344, },  
 {-358, -325, -176, 33, 232, 354, 344, 215, 10, -194, -325, -350, -243, -45, 168, 321, 353, 264, 77, -136,  
 -297, -354, -279, -108, 95, 271, 354, 312, 150, -60, -244, -341, },  
 20 {-355, -283, -75, 173, 335, 338, 186, -53, -267, -357, -274, -66, 176, 335, 338, 174, -80, -291, -362, -2  
 60, -34, 205, 339, 316, 150, -86, -293, -367, -254, -30, 204, 348, },  
 {-363, -236, 38, 289, 358, 214, -50, -287, -351, -206, 65, 292, 342, 190, -80, -302, -345, -183, 105, 330,  
 344, 152, -132, -330, -326, -134, 151, 350, 319, 108, -156, -336, },  
 {-373, -185, 144, 369, 308, 11, -276, -357, -173, 135, 323, 281, 45, -240, -347, -187, 116, 337, 298, 33,  
 25 -256, -361, -192, 118, 335, 314, 46, -263, -354, -188, 111, 321, },  
 {-325, -123, 201, 346, 170, -151, -339, -230, 93, 337, 273, -37, -319, -321, -12, 310, 340, 57, -269, -35  
 4, -123, 233, 373, 176, -179, -372, -225, 126, 356, 264, -59, -325, },  
 {-298, -57, 250, 290, 38, -281, -314, 5, 320, 317, -32, -371, -284, 98, 354, 253, -138, -379, -191, 185, 3  
 65, 151, -235, -357, -96, 256, 339, 58, -296, -325, 1, 316, },  
 30 {316, 7, -291, -255, 91, 357, 165, -238, -348, -43, 325, 301, -110, -385, -157, 257, 335, -12, -323, -227  
 , 152, 354, 81, -292, -291, 57, 356, 204, -228, -364, -46, 324, },  
 {395, -64, -420, -184, 313, 354, -105, -409, -130, 325, 303, -157, -358, -49, 307, 222, -180, -314, 14, 3  
 16, 160, -226, -278, 62, 309, 127, -245, -268, 111, 311, 75, -255, },  
 {-309, 117, 342, 13, -325, -138, 257, 255, -177, -328, 77, 370, 22, -362, -130, 301, 254, -217, -328, 97,  
 35 362, 54, -352, -199, 275, 315, -151, -371, 14, 364, 130, -287, },  
 {275, -151, -299, 97, 303, -33, -297, -43, 302, 106, -303, -177, 299, 229, -282, -265, 252, 314, -207, -3  
 61, 144, 398, -72, -416, 7, 390, 55, -356, -101, 329, 173, -278, },  
 {358, -271, -337, 269, 313, -257, -305, 250, 295, -242, -278, 222, 271, -223, -266, 234, 252, -240, -234  
 , 242, 225, -250, -221, 251, 216, -242, -211, 248, 201, -250, -202, 232, },  
 40 {-288, 277, 218, -316, -128, 316, 75, -318, -17, 314, -58, -300, 128, 288, -218, -240, 281, 178, -316, -1  
 19, 346, 47, -369, 34, 376, -103, -379, 177, 348, -237, -315, 289, },  
 {239, -287, -111, 340, -40, -307, 138, 262, -235, -183, 305, 99, -363, 34, 358, -194, -266, 289, 147, -33  
 6, -16, 360, -146, -316, 300, 184, -393, 5, 387, -166, -313, 252, },  
 {245, -337, -36, 374, -196, -271, 345, 91, -388, 117, 312, -282, -134, 342, -73, -287, 235, 162, -326, -8  
 45 , 355, -215, -217, 360, -22, -335, 252, 148, -351, 81, 275, -194, },  
 {-220, 350, -71, -314, 329, 85, -390, 196, 221, -347, 61, 287, -271, -90, 334, -162, -216, 330, -20, -328  
 , 275, 118, -375, 189, 224, -366, 84, 280, -328, -3, 311, -195, },  
 {220, -402, 206, 208, -426, 212, 208, -398, 171, 230, -358, 78, 255, -286, 25, 248, -232, -58, 293, -206,  
 -96, 318, -242, -116, 387, -249, -131, 360, -255, -91, 337, -190, },  
 50 {-109, 205, -107, -104, 227, -148, -90, 296, -231, -83, 339, -292, -13, 329, -384, 100, 276, -412, 206, 1  
 87, -430, 294, 68, -362, 380, -76, -285, 390, -191, -154, 346, -181, },  
 {145, -308, 250, 1, -256, 343, -173, -154, 367, -287, -6, 310, -404, 175, 217, -446, 323, 50, -373, 393, -  
 117, -218, 356, -252, 20, 193, -272, 200, -18, -194, 268, -124, },  
 {-192, 416, -395, 137, 189, -394, 362, -109, -194, 357, -290, 59, 183, -312, 258, -61, -144, 276, -273, 1  
 55 04, 125, -269, 283, -168, -46, 259, -358, 267, 6, -303, 392, -181, },  
 {-148, 336, -385, 261, -26, -195, 315, -299, 143, 98, -288, 346, -264, 56, 179, -314, 307, -159, -79, 294  
 , -372, 294, -122, -95, 275, -339, 265, -55, -202, 380, -380, 165, },

{126, -300, 383, -353, 220, -9, -211, 353, -375, 266, -62, -169, 336, -380, 306, -134, -82, 265, -358, 32  
9, -190, -7, 180, -290, 315, -243, 97, 80, -236, 319, -280, 114, },  
{-92, 228, -323, 369, -352, 259, -107, -63, 205, -289, 296, -215, 77, 88, -250, 360, -388, 320, -186, 16,  
150, -263, 302, -259, 148, 3, -154, 284, -385, 420, -342, 138, },  
5 {86, -222, 322, -387, 412, -383, 303, -179, 38, 104, -238, 332, -353, 311, -241, 140, -7, -131, 245, -318  
, 338, -316, 261, -162, 39, 86, -191, 267, -316, 314, -240, 92, },  
{-10, 41, -90, 147, -217, 302, -371, 407, -425, 416, -372, 298, -215, 139, -69, 17, 14, -21, -1, 52, -121,  
196, -274, 347, -394, 401, -376, 335, -286, 222, -138, 48, },  
{38, -92, 129, -147, 158, -162, 145, -102, 46, 22, -104, 198, -286, 361, -430, 482, -510, 511, -482, 422,  
10 -349, 275, -193, 100, -12, -58, 106, -139, 162, -165, 133, -54, },  
{-35, 90, -136, 176, -217, 261, -296, 320, -339, 347, -338, 310, -270, 225, -175, 117, -50, -22, 97, -173  
, 241, -296, 341, -373, 392, -386, 357, -315, 272, -218, 146, -54, }。

变换矩阵尺寸 $64 \times 64$ :

{67, 75, 83, 90, 98, 106, 113, 119, 126, 133, 141, 148, 156, 163, 171, 178, 185, 192, 199, 206, 212, 218, 22  
15 3, 230, 236, 242, 248, 253, 259, 264, 269, 274, 278, 282, 286, 289, 292, 296, 298, 302, 305, 307, 310, 312,  
315, 317, 319, 321, 321, 323, 323, 324, 324, 323, 323, 322, 320, 318, 315, 313, 309, 306, 302, 298, },  
{-176, -197, -217, -235, -251, -266, -279, -292, -302, -312, -321, -328, -333, -338, -339, -340, -339,  
-338, -336, -332, -325, -317, -310, -301, -288, -275, -260, -244, -229, -211, -192, -172, -150, -129, -  
106, -83, -61, -39, -17, 6, 31, 54, 79, 102, 126, 148, 170, 189, 208, 225, 242, 258, 274, 287, 299, 308, 316  
20 , 322, 326, 327, 327, 324, 320, 314, },  
{ 260, 287, 308, 326, 338, 346, 351, 352, 347, 338, 325, 309, 289, 264, 237, 208, 175, 141, 105, 70, 33, -4  
, -42, -80, -118, -154, -188, -220, -248, -274, -294, -313, -328, -339, -345, -347, -345, -338, -326, -3  
11, -291, -269, -242, -213, -180, -144, -104, -63, -23, 15, 53, 93, 133, 169, 203, 233, 260, 284, 302, 316  
, 326, 332, 333, 327, },  
25 {285, 315, 335, 347, 347, 339, 324, 300, 268, 230, 186, 137, 86, 34, -20, -73, -127, -174, -217, -255, -28  
7, -314, -334, -347, -351, -344, -328, -304, -272, -232, -188, -137, -80, -22, 35, 91, 145, 193, 237, 276  
, 309, 334, 351, 359, 359, 347, 328, 301, 264, 220, 172, 121, 63, 4, -56, -113, -168, -216, -257, -291, -31  
7, -333, -341, -338, },  
{301, 326, 337, 334, 317, 288, 243, 188, 126, 61, -6, -74, -139, -202, -255, -297, -330, -348, -351, -340  
30 , -317, -284, -237, -178, -109, -35, 43, 116, 186, 247, 295, 334, 357, 365, 357, 333, 296, 248, 189, 119,  
41, -34, -108, -179, -247, -303, -341, -363, -368, -360, -332, -290, -233, -169, -99, -25, 50, 120, 184,  
238, 280, 311, 328, 330, },  
{319, 346, 349, 327, 283, 222, 147, 62, -29, -120, -203, -274, -325, -356, -365, -353, -318, -263, -192,  
-112, -22, 68, 154, 234, 304, 351, 369, 364, 338, 288, 223, 142, 49, -43, -128, -206, -269, -316, -343, -3  
35 50, -335, -299, -238, -162, -75, 19, 112, 195, 264, 317, 349, 356, 336, 294, 232, 158, 76, -9, -93, -172, -  
240, -293, -322, -328, },  
{ 334, 351, 334, 289, 216, 126, 24, -84, -186, -271, -330, -362, -362, -333, -271, -183, -75, 36, 139, 23  
0, 300, 347, 363, 346, 294, 215, 113, 1, -110, -207, -281, -333, -352, -339, -298, -232, -143, -40, 69, 17  
3, 263, 325, 358, 357, 321, 254, 162, 57, -54, -158, -247, -314, -351, -354, -324, -265, -183, -93, 6, 108  
40 , 202, 276, 322, 339, },  
{ 322, 331, 294, 225, 124, 6, -110, -214, -290, -336, -344, -313, -247, -150, -33, 91, 208, 301, 353, 365  
, 332, 260, 159, 32, -102, -217, -303, -355, -365, -324, -245, -139, -10, 117, 230, 320, 363, 364, 316, 22  
7, 110, -17, -145, -256, -332, -367, -354, -297, -204, -85, 47, 171, 273, 341, 362, 340, 277, 186, 71, -50  
, -164, -253, -309, -332, },  
45 { 349, 342, 280, 175, 41, -99, -217, -302, -341, -335, -278, -176, -49, 82, 200, 292, 340, 335, 276, 176,  
49, -89, -214, -308, -353, -339, -268, -154, -12, 123, 237, 316, 342, 323, 253, 142, 5, -138, -256, -334,  
-362, -335, -251, -124, 29, 181, 296, 361, 368, 318, 213, 71, -86, -228, -325, -372, -363, -300, -188, -5  
2, 98, 234, 326, 371, },  
{ 383, 369, 277, 132, -41, -203, -321, -379, -368, -287, -151, 8, 164, 295, 367, 364, 288, 161, 8, -144, -  
50 271, -345, -348, -289, -169, -16, 143, 276, 351, 351, 278, 151, -13, -171, -290, -350, -335, -257, -133,  
20, 173, 286, 341, 330, 253, 122, -34, -176, -284, -336, -316, -233, -101, 48, 187, 294, 341, 324, 246, 11  
9, -34, -185, -297, -355, },  
{ 378, 339, 206, 27, -152, -291, -364, -352, -255, -101, 79, 238, 337, 367, 309, 169, -19, -199, -327, -3  
72, -329, -212, -46, 133, 286, 365, 358, 264, 96, -91, -247, -343, -354, -292, -161, 16, 190, 316, 362, 32  
55 5, 204, 39, -142, -285, -351, -332, -223, -65, 105, 246, 324, 328, 244, 102, -57, -205, -298, -327, -285,  
-176, -24, 139, 265, 340, },  
{-345, -287, -142, 33, 196, 302, 323, 255, 113, -59, -213, -309, -315, -236, -83, 103, 254, 326, 306, 202,  
43, -130, -269, -332, -311, -194, -9, 179, 315, 350, 283, 139, -52, -229, -335, -350, -267, -105, 87, 262

, 365, 362, 241, 52, -157, -325, -401, -345, -176, 35, 238, 369, 383, 290, 114, -94, -269, -376, -380, -276, -84, 122, 290, 386, },  
 {-383, -300, -117, 99, 283, 379, 342, 189, -32, -231, -339, -347, -242, -53, 156, 310, 357, 292, 124, -81, -249, -341, -314, -191, 2, 202, 331, 344, 224, 29, -166, -307, -339, -266, -107, 91, 262, 355, 323, 177, -33, -233, -349, -342, -209, -2, 210, 343, 340, 227, 39, -163, -311, -358, -275, -99, 113, 288, 364, 326, 166, -57, -251, -355, },  
 {-329, -241, -57, 145, 291, 333, 240, 55, -158, -310, -336, -241, -56, 157, 320, 368, 259, 51, -171, -333, -357, -237, -33, 177, 313, 335, 230, 25, -200, -348, -347, -202, 39, 255, 356, 325, 165, -64, -263, -368, -324, -152, 91, 299, 381, 300, 95, -151, -335, -378, -261, -36, 193, 347, 354, 219, 4, -217, -348, -339, -206, 13, 223, 349, },  
 {-367, -244, -2, 236, 364, 325, 148, -97, -301, -377, -284, -61, 188, 359, 368, 200, -57, -275, -369, -303, -99, 154, 321, 349, 234, 20, -230, -383, -344, -147, 107, 312, 369, 267, 42, -209, -340, -321, -157, 82, 272, 332, 239, 44, -176, -313, -321, -167, 83, 290, 356, 250, 24, -213, -335, -301, -131, 96, 280, 336, 237, 37, -181, -326, },  
 {-363, -215, 40, 264, 348, 253, 39, -189, -320, -292, -115, 117, 280, 323, 197, -48, -272, -350, -238, -4, 219, 321, 256, 87, -126, -291, -316, -175, 79, 290, 347, 227, -29, -271, -360, -270, -34, 238, 365, 298, 75, -186, -345, -325, -134, 139, 359, 361, 162, -109, -341, -380, -208, 65, 299, 387, 266, 11, -255, -407, -333, -81, 194, 389, },  
 {-368, -202, 87, 331, 374, 194, -97, -329, -362, -204, 73, 313, 372, 229, -44, -302, -399, -248, 57, 310, 371, 229, -39, -282, -359, -223, 47, 290, 359, 213, -49, -290, -357, -228, 26, 284, 365, 224, -39, -282, -361, -211, 64, 291, 350, 187, -97, -314, -325, -152, 127, 324, 310, 116, -140, -309, -295, -113, 136, 310, 291, 94, -134, -278, },  
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 30 2,-148, 54,}。

具体的，在一实施例中，用于帧间预测残差的第一精度 MMT 矩阵如下所  
 示。变换矩阵尺寸  $4 \times 4$ ：

35 { -7, -54, -95, -67, },  
 { -76, -82, 9, 62, },  
 { -80, 18, 53, -82, },  
 { 64, -80, 67, -37, }。

变换矩阵尺寸  $8 \times 8$ ：

40 { 12, 28, 47, 73, 93, 91, 73, 45, },  
 { -49, -80, -91, -64, -7, 49, 73, 61, },  
 { 76, 84, 27, -57, -83, -6, 67, 68, },  
 { 66, 45, -55, -79, 47, 82, -22, -88, },  
 { 75, 5, -76, 14, 75, -61, -56, 93, },  
 { 97, -64, -49, 89, -52, -3, 55, -55, },  
 { -61, 96, -79, 30, 24, -68, 75, -43, },  
 45 { 34, -57, 63, -69, 77, -84, 73, -36, }。

变换矩阵尺寸  $16 \times 16$ ：

50 { 24, 34, 40, 54, 70, 81, 89, 90, 86, 83, 79, 69, 55, 46, 33, 16, },  
 { -16, -36, -57, -78, -90, -83, -60, -22, 15, 47, 76, 88, 87, 77, 63, 49, },  
 { 56, 79, 90, 81, 49, -3, -55, -89, -87, -61, -22, 31, 69, 76, 59, 36, },  
 { 77, 87, 67, 23, -31, -75, -77, -30, 38, 82, 81, 29, -39, -77, -82, -62, },  
 { 62, 56, 36, 0, -56, -70, -6, 71, 82, 16, -66, -103, -62, 32, 94, 94, },  
 { 85, 72, 13, -73, -102, 1, 89, 70, -27, -87, -44, 43, 68, 18, -49, -70, },

5 {93,47,-50,-93,-5,98,43,-67,-72,25,68,1,-74,-50,42,86,},  
 {76,19,-77,-61,63,49,-55,-51,54,67,-51,-87,48,94,-18,-94,},  
 {74,4,-91,-9,106,-27,-80,60,60,-86,-39,88,16,-78,-11,56,},  
 {55,-24,-70,48,43,-78,15,75,-85,-37,98,-20,-85,73,48,-85,},  
 10 {101,-84,-53,99,-24,-52,71,-19,-49,71,-28,-41,83,-33,-66,68,},  
 {75,-95,2,69,-78,52,8,-75,82,-27,-39,78,-60,-11,86,-74,},  
 {51,-86,57,3,-48,90,-92,48,22,-78,90,-60,5,53,-85,54,},  
 {27,-56,61,-38,4,32,-68,84,-75,50,-10,-36,79,-109,111,-61,},  
 {-38,79,-86,72,-49,20,7,-34,57,-76,89,-92,86,-72,53,-24,},  
 {33,-70,88,-89,86,-88,87,-74,64,-63,58,-45,33,-24,19,-9,}。

变换矩阵尺寸 $32 \times 32$ :

{-16,-18,-21,-25,-27,-31,-38,-45,-53,-58,-63,-68,-74,-78,-82,-85,-86,-87,-87,-86,-84,-  
 83,-83,-80,-76,-72,-68,-60,-51,-46,-42,-34,},  
 15 {-52,-64,-75,-87,-93,-97,-97,-93,-91,-88,-83,-70,-57,-45,-32,-16,1,15,25,33,41,50,57,6  
 2,67,69,67,65,59,51,45,39,},  
 {-41,-50,-55,-60,-64,-65,-59,-48,-35,-19,0,21,40,57,71,83,88,87,79,63,45,25,-1,-29,-55  
 ,-76,-90,-96,-99,-97,-88,-72,},  
 {-46,-59,-70,-80,-79,-67,-43,-8,24,53,73,85,92,87,70,43,13,-21,-49,-75,-90,-96,-90,-70  
 ,-38,-4,25,54,70,73,71,58,},  
 20 {-63,-80,-86,-77,-53,-19,19,54,84,97,90,63,27,-16,-52,-78,-88,-76,-52,-24,13,49,75,88,  
 79,52,16,-21,-55,-76,-80,-72,},  
 {-40,-48,-51,-44,-25,6,36,62,79,71,40,-5,-52,-83,-88,-64,-21,31,79,101,88,46,-12,-64,-  
 96,-100,-77,-28,31,77,98,92,},  
 25 {-86,-97,-82,-38,23,81,110,100,61,0,-62,-100,-95,-54,16,76,100,77,27,-29,-68,-73,-52,-  
 15,24,47,52,39,7,-25,-41,-43,},  
 {-79,-81,-51,5,58,81,61,14,-33,-67,-62,-30,23,72,85,52,-13,-78,-97,-61,4,69,92,69,8,-5  
 7,-97,-85,-29,37,87,94,},  
 {-80,-82,-43,18,79,97,56,-22,-87,-87,-27,56,96,68,-7,-77,-87,-35,40,84,72,11,-54,-82,-  
 54,7,59,80,55,0,-57,-78,},  
 30 {-64,-53,-7,44,75,54,-13,-77,-87,-14,76,98,39,-51,-99,-62,36,103,78,-14,-90,-89,-18,56  
 ,82,43,-29,-77,-65,-10,54,78,},  
 {-95,-69,15,103,101,5,-97,-109,-13,95,95,6,-73,-80,-5,75,61,-17,-64,-48,14,61,51,-8,-6  
 0,-56,2,64,70,21,-38,-68,},  
 35 {56,40,-17,-66,-46,23,66,40,-45,-69,-4,63,56,-22,-75,-40,59,89,4,-97,-77,34,99,68,-37,  
 -114,-65,57,114,60,-44,-94,},  
 {80,38,-50,-88,-26,67,73,-15,-94,-45,70,95,-14,-108,-40,86,82,-37,-97,-24,75,68,-19,-7  
 9,-42,49,73,8,-67,-58,16,67,},  
 {-115,-30,93,93,-19,-109,-25,110,60,-73,-71,36,80,0,-78,-32,57,53,-35,-73,2,73,37,-55,  
 -67,15,75,30,-55,-68,9,69,},  
 40 {50,8,-45,-41,21,64,-3,-75,-9,78,18,-81,-33,84,47,-89,-51,80,54,-65,-65,42,82,-6,-99,-  
 43,84,86,-51,-119,-1,108,},  
 {71,-3,-75,-28,64,48,-61,-66,67,72,-77,-79,96,73,-108,-55,92,53,-70,-54,47,60,-29,-72,  
 16,80,-6,-80,-8,73,22,-62,},  
 {-60,9,66,9,-65,-19,71,18,-88,4,92,-17,-98,34,90,-67,-54,94,15,-100,8,93,-5,-94,5,91,7  
 ,-90,-17,97,28,-82,},  
 45 {55,-11,-62,0,56,-1,-58,11,63,-45,-46,67,16,-81,28,76,-79,-43,107,6,-115,18,107,-35,-9  
 8,48,85,-65,-72,83,58,-83,},  
 {98,-41,-100,32,97,-40,-83,61,50,-80,1,72,-48,-38,73,-13,-67,65,27,-89,28,81,-72,-54,9  
 7,7,-85,26,68,-52,-49,61,},  
 50 {-75,45,78,-49,-53,63,26,-71,15,58,-54,-22,79,-44,-45,103,-56,-56,109,-40,-73,93,9,-99  
 ,58,59,-87,-5,85,-48,-58,63,},  
 {63,-48,-42,52,15,-58,11,62,-51,-36,93,-47,-51,96,-56,-28,95,-93,9,92,-103,2,99,-76,-3  
 2,91,-41,-51,85,-16,-75,58,},  
 {-60,45,48,-63,-21,92,-47,-71,123,-58,-47,108,-71,-17,82,-85,28,51,-87,54,8,-57,59,-3,  
 55 -62,70,-4,-70,74,12,-90,58,},  
 {84,-94,-40,126,-68,-61,110,-46,-45,92,-77,4,68,-77,30,27,-63,62,-26,-24,53,-55,18,41,  
 -68,38,25,-76,59,23,-93,64,},

{84, -126, 27, 111, -148, 59, 53, -110, 90, -30, -38, 73, -61, 29, 5, -42, 57, -41, 9, 23, -51, 54, -15, -39, 61, -32, -24, 60, -42, -23, 76, -49, },  
 {-52, 103, -83, 11, 71, -114, 96, -32, -38, 86, -93, 55, 7, -53, 72, -64, 28, 21, -65, 81, -54, -4, 66, -84, 4, 7, 22, -73, 66, -14, -51, 79, -43, },  
 5 {53, -93, 77, -27, -27, 59, -68, 52, -18, -19, 46, -63, 62, -46, 11, 31, -67, 79, -66, 22, 42, -94, 99, -48, -27, 89, -105, 56, 25, -94, 115, -62, },  
 {48, -97, 97, -66, 21, 24, -51, 59, -62, 59, -33, -7, 39, -54, 52, -34, 9, 22, -56, 72, -60, 18, 39, -86, 104, -86, 32, 36, -96, 122, -111, 55, },  
 {-34, 69, -79, 62, -30, -9, 42, -63, 77, -87, 76, -38, -10, 58, -92, 110, -115, 105, -80, 44, -3, -39, 65, -7, 4, 65, -42, 1, 41, -62, 67, -57, 27, },  
 10 {23, -49, 62, -68, 62, -46, 29, -2, -26, 61, -95, 120, -132, 121, -95, 59, -20, -18, 53, -81, 94, -94, 72, -3, 3, 1, 24, -41, 44, -37, 27, -15, 5, },  
 {-32, 67, -81, 80, -71, 59, -44, 23, -2, -11, 20, -34, 44, -51, 61, -70, 78, -87, 95, -99, 102, -96, 77, -46, 9, 30, -63, 80, -82, 71, -53, 25, },  
 15 {-28, 59, -76, 88, -100, 114, -121, 115, -101, 92, -82, 71, -60, 52, -44, 40, -40, 42, -46, 51, -53, 49, -43, 39, -38, 40, -35, 27, -17, 9, -4, 2, },  
 {12, -26, 32, -33, 40, -46, 45, -40, 33, -28, 25, -20, 14, -9, 4, 0, -5, 9, -14, 26, -46, 67, -87, 103, -118, 1, 34, -139, 132, -111, 85, -57, 24, }。

具体的，在一实施例中，用于帧间预测残差的第二精度 MMT 矩阵如下所

20 示。变换矩阵尺寸  $4 \times 4$ ：

{-27, -216, -378, -267, },  
 {-303, -329, 35, 248, },  
 {-322, 72, 214, -328, },  
 {257, -319, 268, -148, }。

25 变换矩阵尺寸  $8 \times 8$ ：

{49, 112, 190, 292, 372, 364, 291, 180, },  
 {-197, -321, -365, -256, -28, 197, 291, 244, },  
 {305, 334, 107, -228, -332, -25, 267, 271, },  
 {263, 180, -219, -317, 190, 328, -88, -350, },  
 30 {301, 21, -305, 54, 301, -242, -226, 370, },  
 {390, -257, -196, 357, -209, -11, 220, -220, },  
 {-243, 382, -317, 122, 96, -270, 301, -174, },  
 {137, -228, 251, -275, 308, -337, 292, -144, }。

变换矩阵尺寸  $16 \times 16$ ：

{97, 136, 161, 216, 280, 323, 355, 361, 343, 333, 318, 276, 219, 185, 133, 64, },  
 {-65, -143, -228, -313, -359, -331, -239, -89, 59, 188, 303, 353, 346, 306, 250, 196, },  
 {225, 317, 362, 324, 195, -11, -221, -357, -348, -243, -88, 123, 274, 302, 237, 145, },  
 {306, 346, 269, 94, -125, -301, -309, -120, 150, 328, 326, 115, -157, -309, -328, -246, },  
 {247, 226, 144, 1, -225, -279, -24, 284, 327, 65, -262, -410, -246, 128, 375, 374, },  
 40 {341, 287, 53, -294, -408, 2, 356, 281, -106, -347, -175, 174, 270, 72, -198, -280, },  
 {372, 190, -200, -372, -19, 392, 174, -267, -287, 99, 271, 3, -296, -201, 170, 343, },  
 {302, 74, -308, -242, 251, 194, -218, -206, 217, 268, -205, -347, 191, 378, -74, -376, },  
 {295, 15, -365, -38, 424, -109, -318, 239, 239, -346, -154, 350, 65, -311, -42, 226, },  
 {220, -95, -279, 193, 172, -314, 58, 298, -342, -148, 394, -82, -341, 292, 193, -341, },  
 45 {402, -337, -213, 398, -95, -210, 283, -75, -197, 284, -112, -166, 332, -131, -265, 272, },  
 {302, -380, 7, 276, -311, 210, 32, -300, 328, -110, -156, 311, -239, -46, 344, -296, },  
 {203, -344, 226, 14, -191, 362, -368, 190, 87, -310, 359, -242, 19, 214, -338, 217, },  
 {109, -225, 243, -153, 17, 127, -270, 336, -302, 202, -40, -145, 315, -435, 445, -245, },  
 {-154, 315, -344, 288, -194, 81, 29, -134, 226, -306, 354, -368, 344, -290, 212, -95, },  
 50 {134, -281, 352, -357, 343, -350, 347, -295, 258, -254, 234, -181, 130, -98, 75, -36, }。

## 变换矩阵尺寸32×32:

{-64,-72,-84,-98,-109,-125,-150,-178,-210,-234,-253,-271,-297,-313,-329,-341,-344,-346  
 ,-346,-345,-338,-332,-331,-320,-306,-289,-271,-238,-206,-184,-166,-135,},  
 {-208,-254,-302,-348,-372,-388,-387,-374,-362,-352,-333,-281,-226,-180,-126,-63,2,60,1  
 5 01,133,163,199,228,246,266,275,269,258,235,203,182,158,},  
 {-163,-200,-219,-242,-257,-259,-236,-190,-142,-78,-1,85,159,229,285,330,352,348,314,25  
 1,179,98,-5,-115,-220,-304,-361,-385,-397,-389,-352,-286,},  
 {-185,-237,-282,-320,-315,-269,-170,-33,95,212,291,341,369,350,281,173,50,-85,-195,-29  
 8,-361,-384,-359,-280,-154,-17,102,217,281,291,283,231,},  
 10 {-251,-322,-346,-310,-213,-74,75,215,334,387,359,251,107,-63,-210,-311,-350,-306,-206,  
 -94,51,197,300,351,318,207,64,-86,-218,-304,-321,-287,},  
 {-159,-194,-203,-175,-98,23,143,250,314,283,161,-21,-208,-330,-351,-255,-84,125,315,40  
 2,351,186,-46,-255,-385,-399,-308,-112,126,308,392,369,},  
 {-344,-388,-329,-152,92,326,438,399,244,1,-247,-401,-381,-214,65,303,399,309,107,-116,  
 15 -272,-290,-206,-60,97,188,207,154,28,-99,-164,-171,},  
 {-317,-323,-203,20,230,326,243,57,-133,-267,-246,-119,91,289,340,208,-50,-312,-390,-24  
 6,17,276,368,275,31,-229,-389,-341,-115,148,346,376,},  
 {-319,-328,-171,70,315,388,226,-89,-350,-349,-106,224,385,273,-29,-309,-348,-140,160,3  
 36,288,45,-216,-327,-216,27,236,321,221,-2,-226,-312,},  
 20 {-258,-213,-29,177,299,215,-54,-308,-347,-55,305,390,158,-203,-396,-248,146,413,314,-5  
 5,-360,-356,-71,225,329,172,-115,-307,-261,-41,216,314,},  
 {-380,-277,61,411,404,20,-389,-438,-53,381,379,25,-291,-320,-19,301,243,-67,-258,-192,  
 57,242,205,-33,-239,-223,8,258,280,83,-150,-273,},  
 {224,159,-68,-262,-185,91,265,159,-179,-275,-18,253,223,-89,-302,-160,235,357,17,-388,  
 25 -309,136,396,272,-148,-457,-261,227,455,238,-177,-374,},  
 {320,150,-201,-351,-106,267,290,-61,-374,-179,279,381,-58,-432,-158,345,326,-147,-388,  
 -96,299,272,-76,-316,-166,195,292,30,-268,-231,62,267,},  
 {-462,-119,372,371,-74,-437,-100,438,240,-291,-283,143,321,1,-314,-127,226,210,-141,-2  
 91,9,292,148,-221,-269,60,298,119,-219,-270,36,276,},  
 30 {201,32,-180,-165,86,256,-11,-301,-36,313,72,-323,-130,336,188,-355,-205,321,215,-261,  
 -258,167,329,-23,-395,-174,336,343,-203,-475,-4,432,},  
 {286,-10,-301,-112,256,190,-243,-265,270,290,-307,-317,386,292,-432,-220,370,213,-279,  
 -216,190,240,-117,-287,63,322,-24,-319,-33,291,87,-248,},  
 {-239,38,263,38,-260,-78,284,72,-351,15,370,-67,-391,135,360,-270,-217,375,61,-399,30,  
 35 374,-18,-376,21,363,27,-359,-68,388,111,-328,},  
 {218,-44,-249,0,224,-3,-231,44,250,-178,-182,269,63,-324,114,306,-315,-171,429,24,-461  
 ,72,429,-138,-393,192,340,-259,-289,334,230,-332,},  
 {393,-164,-402,127,390,-159,-334,245,201,-319,5,287,-193,-153,292,-53,-268,259,109,-35  
 5,112,325,-289,-216,386,28,-338,105,272,-210,-195,244,},  
 40 {-299,179,312,-197,-213,253,103,-282,59,233,-214,-90,315,-178,-180,410,-226,-224,435,-  
 159,-291,371,35,-397,231,237,-349,-18,339,-193,-232,251,},  
 {250,-190,-169,207,58,-230,42,247,-206,-142,372,-187,-205,383,-225,-114,380,-374,37,36  
 8,-413,7,394,-304,-129,364,-162,-204,340,-65,-300,233,},  
 {-240,182,193,-253,-84,368,-189,-282,494,-232,-187,431,-285,-67,329,-338,114,203,-348,  
 45 216,30,-229,235,-11,-249,279,-18,-280,296,47,-359,230,},  
 {338,-377,-162,506,-271,-243,441,-186,-179,369,-308,16,273,-307,120,109,-250,249,-103,  
 -96,212,-222,71,162,-274,154,100,-305,236,94,-370,258,},  
 {338,-505,110,445,-593,236,212,-438,362,-122,-152,293,-243,117,18,-166,230,-164,38,91,  
 -205,215,-61,-157,246,-128,-94,242,-167,-93,304,-198,},  
 50 {-209,412,-333,45,284,-457,385,-127,-150,344,-371,218,29,-213,286,-256,112,85,-261,323  
 ,-218,-18,266,-338,187,86,-292,264,-55,-206,316,-172,},  
 {214,-371,307,-107,-109,237,-270,210,-72,-75,183,-253,249,-182,45,125,-267,317,-263,88  
 ,169,-376,397,-193,-108,356,-419,224,102,-376,459,-248,},  
 {192,-390,387,-265,83,96,-204,238,-249,237,-132,-27,156,-216,206,-137,36,88,-225,287,-  
 55 238,73,157,-345,417,-344,127,146,-382,488,-442,221,},  
 {-138,275,-314,248,-121,-36,169,-251,307,-348,304,-152,-38,234,-369,439,-460,421,-320,  
 176,-12,-155,259,-294,259,-168,4,164,-250,266,-226,107,},  
 {93,-198,246,-273,247,-183,115,-8,-106,244,-380,481,-528,484,-379,238,-79,-70,210,-324  
 ,376,-375,288,-131,2,98,-164,176,-150,106,-59,22,},

{-126, 269, -323, 321, -283, 235, -177, 91, -7, -43, 80, -135, 177, -206, 243, -281, 311, -349, 379, -397, 410, -384, 309, -185, 37, 119, -250, 320, -329, 282, -213, 98, },  
{-113, 238, -305, 352, -399, 454, -483, 461, -406, 366, -328, 284, -240, 208, -177, 159, -162, 169, -185, 205, -212, 196, -174, 156, -152, 161, -140, 107, -68, 34, -18, 7, },  
5 {49, -105, 126, -132, 160, -183, 182, -161, 132, -110, 98, -78, 56, -38, 17, 1, -20, 38, -57, 105, -184, 268, -347, 413, -473, 535, -556, 526, -445, 338, -228, 97, }。

进一步的，基于本说明书实施例的编码变换方法，本说明书实施例还提出了一种解码变换方法。如图 3 所示，在一实施例中，解码变换方法包括：

S310，确定码流中残差变换结果对应的变换矩阵或变换矩阵组合；

10 S320，使用步骤 S310 确定的变换矩阵或变换矩阵组合对码流中残差变换结果进行反变换。

具体的，在一实施例中，在步骤 S310 中，根据从码流中读取的变换选择标记确定码流中残差变换结果对应的变换矩阵或变换矩阵组合。

进一步的，在一实施例中，在步骤 S310 中，确定码流中残差变换结果对  
15 应的变换矩阵或变换矩阵组合，包括：

确定预测残差块的来源，基于预测残差块的来源确定码流中残差变换结果对应的变换矩阵或变换矩阵组合，其中，预测残差块的来源包括帧内预测以及帧间预测。

进一步的，在一实施例中，用于解码变换的变换矩阵包括 MMT 和/或 DCT  
20 变换矩阵。

具体的，如图 4 所示，在一实施例中，针对采用 MMT 以及 DCT 变换矩阵的编码变换方法，对应的解码变换方法包括：

S410，读取码流中的变换选择标记；

S420，读取码流中的变换系数（残差变换结果）并进行反量化；

25 S430，根据变换选择标记判断当前变换系数是否采用了 MMT 变换矩阵；

S440，如果当前变换系数采用了 MMT 变换矩阵，基于 MMT 变换矩阵进行变换系数的反变换；

S450，如果当前变换系数没有采用 MMT 变换矩阵，基于 DCT 变换矩阵进行变换系数的反变换；

S460, 根据步骤 S440 或 S450 的反变换结果进行当前编码块的重建。

进一步的, 在一实施例中,

进一步的, 基于本说明书实施例的编码变换方法, 本说明书实施例还提出了一种编码变换系统。如图 5 所示, 在一实施例中, 系统包括:

5        编码变换模块 510, 其配置为使用多个变换矩阵分别对预测残差块进行变换编码, 获取残差变换结果;

决策模块 520, 其配置为基于编码变换模块 410 输出的残差变换结果, 通过率失真优化决策从多个变换矩阵中选择与预测残差块的残差特性匹配的变换矩阵或变换矩阵组合, 确定用于码流输出的残差变换结果。

10       进一步的, 基于本说明书实施例的解码变换方法, 本说明书实施例还提出了一种解码变换系统。如图 6 所示, 在一实施例中, 系统包括:

变换矩阵确认模块 610, 其配置为确定码流中残差变换结果对应的变换矩阵或变换矩阵组合;

15       解码变换模块 620, 其配置为使用变换矩阵确认模块 510 确定的变换矩阵或变换矩阵组合对码流中的残差变换结果进行反变换。

基于本说明书实施例的方法, 本说明书实施例还提出了一种计算机可读介质, 其上存储有计算机可读指令, 计算机可读指令可被处理器执行以实现本说明书实施例所述的方法。

20       基于本说明书实施例的方法, 本说明书实施例还提出了一种用于在用户设备端进行信息处理的设备, 该设备包括用于存储计算机程序指令的存储器和用于执行程序指令的处理器, 其中, 当该计算机程序指令被该处理器执行时, 触发该设备执行本说明书实施例所述的方法。

25       在 20 世纪 90 年代, 对于一个技术的改进可以很明显地区分是硬件上的改进(例如, 对二极管、晶体管、开关等电路结构的改进)还是软件上的改进(对于方法流程的改进)。然而, 随着技术的发展, 当今的很多方法流程的改进已经可以视为硬件电路结构的直接改进。设计人员几乎都通过将改进的方法流程

编程到硬件电路中来得到相应的硬件电路结构。因此，不能说一个方法流程的改进就不能用硬件实体模块来实现。例如，可编程逻辑器件（Programmable Logic Device,PLD）（例如现场可编程门阵列（Field Programmable Gate Array, FPGA））就是这样一种集成电路，其逻辑功能由用户对器件编程来确定。由设计人员自行编程来把一个数字系统“集成”在一片 PLD 上，而不需要请芯片制造厂商来设计和制作专用的集成电路芯片。而且，如今，取代手工地制作集成电路芯片，这种编程也多半改用“逻辑编译器（logic compiler）”软件来实现，它与程序开发撰写时所用的软件编译器相类似，而要编译之前的原始代码也得用特定的编程语言来撰写，此称之为硬件描述语言（Hardware Description Language, HDL），而 HDL 也并非仅有一种，而是有许多种，如 ABEL（Advanced Boolean Expression Language）、AHDL（Altera Hardware Description Language）、Confluence、CUPL（Cornell University Programming Language）、HDCal、JHDL（Java Hardware Description Language）、Lava、Lola、MyHDL、PALASM、RHDL（Ruby Hardware Description Language）等，目前最普遍使用的是 VHDL（Very-High-Speed Integrated Circuit Hardware Description Language）与 Verilog。本领域技术人员也应该清楚，只需要将方法流程用上述几种硬件描述语言稍作逻辑编程并编程到集成电路中，就可以很容易得到实现该逻辑方法流程的硬件电路。

控制器可以按任何适当的方式实现，例如，控制器可以采取例如微处理器或处理器以及存储可由该（微）处理器执行的计算机可读程序代码（例如软件或固件）的计算机可读介质、逻辑门、开关、专用集成电路（Application Specific Integrated Circuit, ASIC）、可编程逻辑控制器和嵌入微控制器的形式，控制器的例子包括但不限于以下微控制器：ARC 625D、Atmel AT91SAM、Microchip PIC18F26K20 以及 Silicone Labs C8051F320，存储器控制器还可以被实现为存储器的控制逻辑的一部分。本领域技术人员也知道，除了以纯计算机可读程序代码方式实现控制器以外，完全可以通过将方法步骤进行逻辑编程来使得控制

器以逻辑门、开关、专用集成电路、可编程逻辑控制器和嵌入微控制器等的形式来实现相同功能。因此这种控制器可以被认为是一种硬件部件，而对其内包括的用于实现各种功能的装置也可以视为硬件部件内的结构。或者甚至，可以将用于实现各种功能的装置视为既可以是实现方法的软件模块又可以是硬件部件内的结构。

上述实施例阐明的系统、装置、模块或单元，具体可以由计算机芯片或实体实现，或者由具有某种功能的产品来实现。一种典型的实现设备为计算机。具体的，计算机例如可以为个人计算机、膝上型计算机、蜂窝电话、相机电话、智能电话、个人数字助理、媒体播放器、导航设备、电子邮件设备、游戏控制台、平板计算机、可穿戴设备或者这些设备中的任何设备的组合。

为了描述的方便，描述以上装置时以功能分为各种单元分别描述。当然，在实施本申请时可以把各单元的功能在同一个或多个软件和/或硬件中实现。

本领域内的技术人员应明白，本发明的实施例可提供为方法、系统、或计算机程序产品。因此，本发明可采用完全硬件实施例、完全软件实施例、或结合软件和硬件方面的实施例的形式。而且，本发明可采用在一个或多个其中包含有计算机可用程序代码的计算机可用存储介质（包括但不限于磁盘存储器、CD-ROM、光学存储器等）上实施的计算机程序产品的形式。

本发明是参照根据本发明实施例的方法、设备（系统）、和计算机程序产品的流程图和/或方框图来描述的。应理解可由计算机程序指令实现流程图和/或方框图中的每一流程和/或方框、以及流程图和/或方框图中的流程和/或方框的结合。可提供这些计算机程序指令到通用计算机、专用计算机、嵌入式处理机或其他可编程数据处理设备的处理器以产生一个机器，使得通过计算机或其他可编程数据处理设备的处理器执行的指令产生用于实现在流程图一个流程或多个流程和/或方框图一个方框或多个方框中指定的功能的装置。

这些计算机程序指令也可存储在能引导计算机或其他可编程数据处理设备以特定方式工作的计算机可读存储器中，使得存储在该计算机可读存储器中

的指令产生包括指令装置的制造品，该指令装置实现在流程图一个流程或多个流程和 / 或方框图一个方框或多个方框中指定的功能。

这些计算机程序指令也可装载到计算机或其他可编程数据处理设备上，使得在计算机或其他可编程设备上执行一系列操作步骤以产生计算机实现的处理，从而在计算机或其他可编程设备上执行的指令提供用于实现在流程图一个流程或多个流程和 / 或方框图一个方框或多个方框中指定的功能的步骤。

在一个典型的配置中，计算设备包括一个或多个处理器(CPU)、输入/输出接口、网络接口和内存。

内存可能包括计算机可读介质中的非永久性存储器，随机存取存储器(RAM)和/或非易失性内存等形式，如只读存储器(ROM)或闪存(flash RAM)。内存是计算机可读介质的示例。

计算机可读介质包括永久性和非永久性、可移动和非可移动媒体可以由任何方法或技术来实现信息存储。信息可以是计算机可读指令、数据结构、程序的模块或其他数据。计算机的存储介质的例子包括，但不限于相变内存(PRAM)、静态随机存取存储器(SRAM)、动态随机存取存储器(DRAM)、其他类型的随机存取存储器(RAM)、只读存储器(ROM)、电可擦除可编程只读存储器(EEPROM)、快闪记忆体或其他内存技术、只读光盘只读存储器(CD-ROM)、数字多功能光盘(DVD)或其他光学存储、磁盒式磁带，磁带磁磁盘存储或其他磁性存储设备或任何其他非传输介质，可用于存储可以被计算设备访问的信息。按照本文中的界定，计算机可读介质不包括暂存电脑可读媒体(transitory media)，如调制的数据信号和载波。

还需要说明的是，术语“包括”、“包含”或者其任何其他变体意在涵盖非排他性的包含，从而使得包括一系列要素的过程、方法、商品或者设备不仅包括那些要素，而且还包括没有明确列出的其他要素，或者是还包括为这种过程、方法、商品或者设备所固有的要素。在没有更多限制的情况下，由语句“包括一个……”限定的要素，并不排除在包括所述要素的过程、方法、商品或者设

备中还存在另外的相同要素。

本申请可以在由计算机执行的计算机可执行指令的一般上下文中描述，例如程序模块。一般地，程序模块包括执行特定任务或实现特定抽象数据类型的例程、程序、对象、组件、数据结构等等。也可以在分布式计算环境中实践本  
5 申请，在这些分布式计算环境中，由通过通信网络而被连接的远程处理设备来执行任务。在分布式计算环境中，程序模块可以位于包括存储设备在内的本地和远程计算机存储介质中。

本说明书中的各个实施例均采用递进的方式描述，各个实施例之间相同相似的部分互相参见即可，每个实施例重点说明的都是与其他实施例的不同之  
10 处。尤其，对于系统实施例而言，由于其基本相似于方法实施例，所以描述的比较简单，相关之处参见方法实施例的部分说明即可。

以上所述仅为本申请的实施例而已，并不用于限制本申请。对于本领域技术人员来说，本申请可以有各种更改和变化。凡在本申请的精神和原理之内所作的任何修改、等同替换、改进等，均应包含在本申请的权利要求范围之内。

## 权 利 要 求 书

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1、一种编码变换方法，其特征在于，所述方法包括：

使用多个变换矩阵分别对预测残差块进行变换编码，获取残差变换结果；

基于所述残差变换结果，通过率失真优化决策从所述多个变换矩阵中选择与所述预测残差块的残差特性匹配的变换矩阵或变换矩阵组合，确定用于码流输出的残差变换结果。

2、根据权利要求1所述的方法，其特征在于，使用多个变换矩阵分别对预测残差块进行变换编码，其中，使用两个不同的变换矩阵分别对预测残差块进行变换编码。

3、根据权利要求1或2所述的方法，其特征在于，所述变换矩阵包括基于矩阵乘法的变换矩阵。

4、根据权利要求1~3中任一项所述的方法，其特征在于，所述变换矩阵包括基于离散余弦变换II型的二维整数变换矩阵。

5、根据权利要求1~4中任一项所述的方法，其特征在于，使用多个变换矩阵分别对预测残差块进行变换编码，包括：

根据所述预测残差块的来源选取进行变换编码的变换矩阵，其中，所述预测残差块的来源包括帧内预测以及帧间预测。

6、根据权利要求1~5中任一项所述的方法，其特征在于，通过率失真优化决策从所述多个变换矩阵中选择与所述预测残差块的残差特性匹配的变换矩阵或变换矩阵组合，其中，针对行变换以及列变换进行分别决策。

7、根据权利要求1~6中任一项所述的方法，其特征在于，通过率失真优化决策从所述多个变换矩阵中选择与所述预测残差块的残差特性匹配的变换矩阵或变换矩阵组合，其中，将被选择的变换矩阵或变换矩阵组合对应的变换选择标记增添到码流中。

8、根据权利要求7所述的方法，其特征在于，将被选择的变换矩阵或变换矩阵组合对应的变换选择标记增添到码流中，其中，根据各种变换矩阵和/

或变换矩阵组合的被选择的概率确定变换选择标识的表达形式。

9、根据权利要求 8 所述的方法，其特征在于，根据各种变换矩阵和/或变换矩阵组合的被选择概率确定变换选择标识的表达形式，其中，针对帧内预测残差：

行变换以及列变换均选择基于离散余弦变换 II 型的二维整数变换矩阵对应的变换选择标识为 000；

行变换选择基于矩阵乘法的变换矩阵、列变换选择基于离散余弦变换 II 型的二维整数变换矩阵对应的变换选择标识为 01；

行变换选择基于离散余弦变换 II 型的二维整数变换矩阵、列变换选择基于矩阵乘法的变换矩阵对应的变换选择标识为 001；

行变换以及列变换均选择基于矩阵乘法的变换矩阵对应的变换选择标识为 1。

10、根据权利要求 8 所述的方法，其特征在于，根据各种变换矩阵和/或变换矩阵组合的被选择概率确定变换选择标识的表达形式，其中，针对帧间预测残差：

行变换以及列变换均选择基于离散余弦变换 II 型的二维整数变换矩阵对应的变换选择标识为 1；

行变换选择基于矩阵乘法的变换矩阵、列变换选择基于离散余弦变换 II 型的二维整数变换矩阵对应的变换选择标识为 01；

行变换选择基于离散余弦变换 II 型的二维整数变换矩阵、列变换选择基于矩阵乘法的变换矩阵对应的变换选择标识为 000；

行变换以及列变换均选择基于矩阵乘法的变换矩阵对应的变换选择标识为 001。

11、一种解码变换方法，其特征在于，所述方法包括：

确定码流中残差变换结果对应的变换矩阵或变换矩阵组合；

使用所述变换矩阵或所述变换矩阵组合对所述残差变换结果进行反变换。

12、根据权利要求 11 所述的方法，其特征在于，所述变换矩阵包括基于矩阵乘法的变换矩阵。

13、根据权利要求 11 或 12 中任一项所述的方法，其特征在于，所述变换矩阵包括基于离散余弦变换 II 型的二维整数变换矩阵。

14、根据权利要求 11~13 中任一项所述的方法，其特征在于，确定码流中残差变换结果对应的变换矩阵或变换矩阵组合，包括：

确定所述预测残差块的来源，基于所述预测残差块的来源确定码流中残差变换结果对应的变换矩阵或变换矩阵组合，其中，所述预测残差块的来源包括帧内预测以及帧间预测。

15、根据权利要求 11~14 中任一项所述的方法，其特征在于，确定码流中残差变换结果对应的变换矩阵或变换矩阵组合，包括：

读取所述码流中的变换选择标识，根据所述变换选择标识确定码流中残差变换结果对应的变换矩阵或变换矩阵组合。

16、一种编码变换系统，其特征在于，包括：

编码变换模块，其配置为使用多个变换矩阵分别对预测残差块进行变换编码，获取残差变换结果；

决策模块，其配置为基于所述残差变换结果，通过率失真优化决策从所述多个变换矩阵中选择与所述预测残差块的残差特性匹配的变换矩阵或变换矩阵组合，确定用于码流输出的残差变换结果。

17、一种解码变换系统，其特征在于，包括：

变换矩阵确认模块，其配置为确定码流中残差变换结果对应的变换矩阵或变换矩阵组合；

解码变换模块，其配置为使用所述变换矩阵或所述变换矩阵组合对所述残差变换结果进行反变换。

18、一种计算机可读介质，其上存储有计算机可读指令，所述计算机可读指令可被处理器执行以实现权利要求 1 至 15 中任一项所述的方法。

19、一种用于在用户设备端进行信息处理的设备，该设备包括用于存储计算机程序指令的存储器和用于执行程序指令的处理器，其中，当该计算机程序指令被该处理器执行时，触发该设备执行权利要求 1 至 15 中任一项所述的方法。

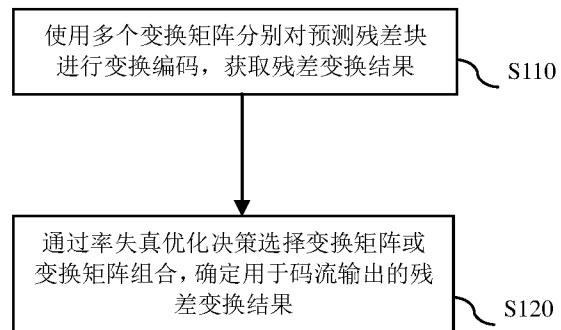


图 1

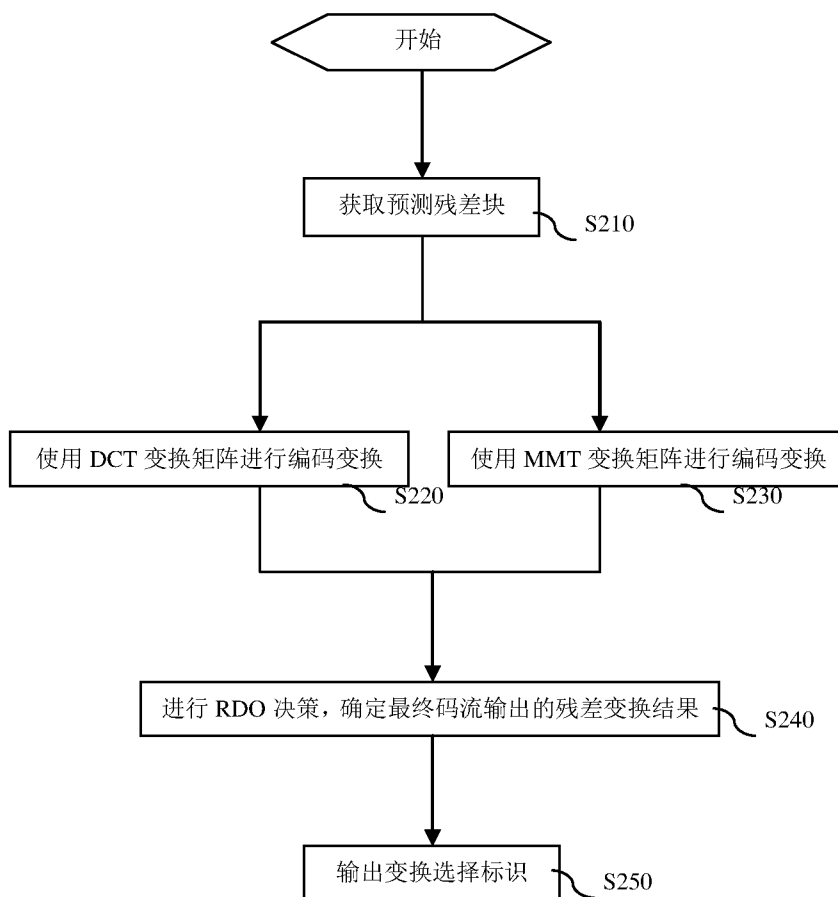


图 2

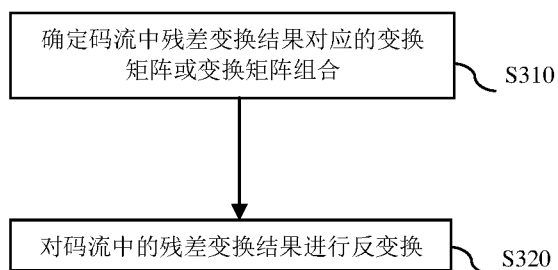


图 3

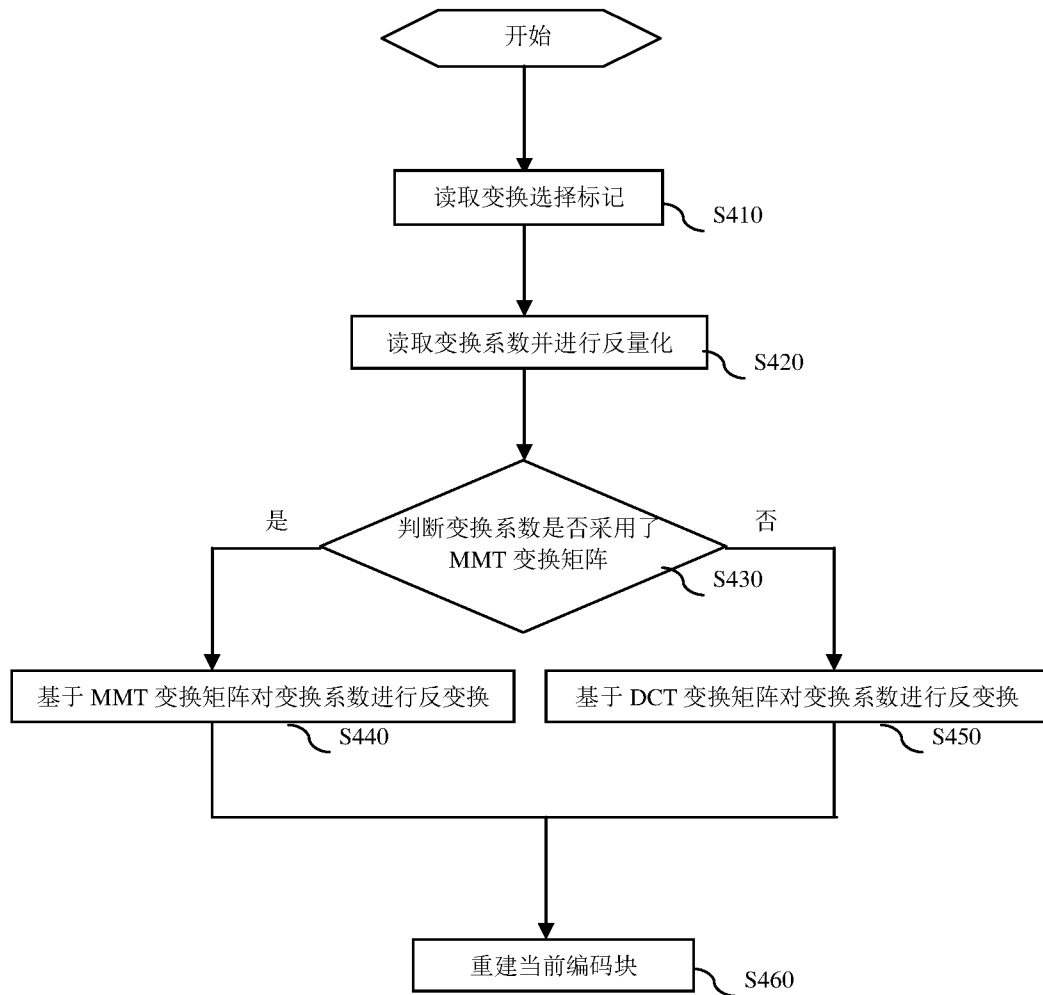


图 4

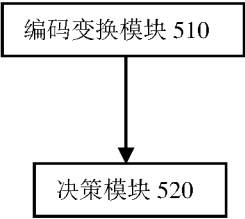


图 5

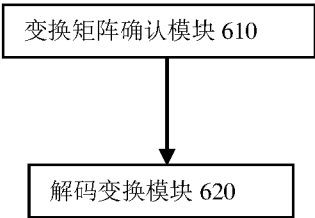


图 6

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2019/075468

**A. CLASSIFICATION OF SUBJECT MATTER**

H04N 19/126(2014.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

H04N19/-;H04N7/-

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

USTXT; EPTXT; CNTXT; CNABS; WOTXT; VEN; CNKI: 编码, 变换矩阵, 残差, 码流, 率失真, 组合, 行变换, 列变换, 选择标记, code, transformation matrix, residual, code stream, rate distortion, combination, row transform, column transform, selection mark

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                | Relevant to claim No. |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X         | CN 102045560 A (HUAWEI TECHNOLOGIES CO., LTD. et al.) 04 May 2011 (2011-05-04)<br>description, paragraphs 65-99, and figures 1-15 | 1-6, 11-14, 16-19     |
| Y         | CN 102045560 A (HUAWEI TECHNOLOGIES CO., LTD. et al.) 04 May 2011 (2011-05-04)<br>description, paragraphs 65-99, and figures 1-15 | 7-10, 15              |
| Y         | CN 102301707 A (THOMSON LICENSING SA) 28 December 2011 (2011-12-28)<br>description, paragraph 95                                  | 7-10, 15              |
| A         | CN 102281435 A (HUAWEI TECHNOLOGIES CO., LTD.) 14 December 2011 (2011-12-14)<br>entire document                                   | 1-19                  |
| A         | CN 101609681 A (BEIJING UNIVERSITY OF TECHNOLOGY et al.) 23 December 2009<br>(2009-12-23)<br>entire document                      | 1-19                  |
| A         | KR 20120033951 A (KOREA ELECTRONICS TELECOMM) 09 April 2012 (2012-04-09)<br>entire document                                       | 1-19                  |



Further documents are listed in the continuation of Box C.



See patent family annex.

\* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

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“&” document member of the same patent family

Date of the actual completion of the international search

14 October 2019

Date of mailing of the international search report

01 November 2019

Name and mailing address of the ISA/CN

China National Intellectual Property Administration  
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Facsimile No. (86-10)62019451

Authorized officer

Telephone No.

**INTERNATIONAL SEARCH REPORT**  
**Information on patent family members**

International application No.

**PCT/CN2019/075468**

| Patent document<br>cited in search report |             |   | Publication date<br>(day/month/year) | Patent family member(s) |              | Publication date<br>(day/month/year) |                   |
|-------------------------------------------|-------------|---|--------------------------------------|-------------------------|--------------|--------------------------------------|-------------------|
| CN                                        | 102045560   | A | 04 May 2011                          | CN                      | 102045560    | B                                    | 07 August 2013    |
|                                           |             |   |                                      | US                      | 2012201303   | A1                                   | 09 August 2012    |
|                                           |             |   |                                      | KR                      | 20120060914  | A                                    | 12 June 2012      |
|                                           |             |   |                                      | AU                      | 2010310286   | B2                                   | 01 May 2014       |
|                                           |             |   |                                      | WO                      | 2011047579   | A1                                   | 28 April 2011     |
|                                           |             |   |                                      | BR                      | 112012011325 | A2                                   | 19 April 2016     |
|                                           |             |   |                                      | KR                      | 101481642    | B1                                   | 22 January 2015   |
|                                           |             |   |                                      | EP                      | 2493197      | A4                                   | 16 July 2014      |
|                                           |             |   |                                      | BR                      | 112012011325 | B1                                   | 30 April 2019     |
|                                           |             |   |                                      | US                      | 9723313      | B2                                   | 01 August 2017    |
|                                           |             |   |                                      | EP                      | 2493197      | A1                                   | 29 August 2012    |
|                                           |             |   |                                      | AU                      | 2010310286   | A1                                   | 14 June 2012      |
|                                           |             |   |                                      | IN                      | 201203557    | P4                                   | 02 August 2013    |
| CN                                        | 102301707   | A | 28 December 2011                     | KR                      | 101834825    | B1                                   | 06 March 2018     |
|                                           |             |   |                                      | EP                      | 2382778      | A4                                   | 15 August 2012    |
|                                           |             |   |                                      | EP                      | 2382778      | A1                                   | 02 November 2011  |
|                                           |             |   |                                      | KR                      | 20170118956  | A                                    | 25 October 2017   |
|                                           |             |   |                                      | KR                      | 20110106403  | A                                    | 28 September 2011 |
|                                           |             |   |                                      | WO                      | 2010087809   | A1                                   | 05 August 2010    |
|                                           |             |   |                                      | JP                      | 2012516627   | A                                    | 19 July 2012      |
|                                           |             |   |                                      | BR                      | PI0924155    | A2                                   | 04 October 2016   |
|                                           |             |   |                                      | US                      | 2011268183   | A1                                   | 03 November 2011  |
|                                           |             |   |                                      | US                      | 9161031      | B2                                   | 13 October 2015   |
|                                           |             |   |                                      | CN                      | 102301707    | B                                    | 02 December 2015  |
| CN                                        | 102281435   | A | 14 December 2011                     | CN                      | 102281435    | B                                    | 02 October 2013   |
|                                           |             |   |                                      | WO                      | 2011153888   | A1                                   | 15 December 2011  |
| CN                                        | 101609681   | A | 23 December 2009                     | CN                      | 101609681    | B                                    | 04 April 2012     |
| KR                                        | 20120033951 | A | 09 April 2012                        | None                    |              |                                      |                   |

## 国际检索报告

国际申请号

PCT/CN2019/075468

| <b>A. 主题的分类</b><br>H04N 19/126(2014.01) i<br><br>按照国际专利分类(IPC)或者同时按照国家分类和IPC两种分类                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                  |                                             |      |                   |         |   |                                                                             |                 |   |                                                                             |         |   |                                                                    |         |   |                                                                |      |   |                                                               |      |   |                                                                                  |      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|---------------------------------------------|------|-------------------|---------|---|-----------------------------------------------------------------------------|-----------------|---|-----------------------------------------------------------------------------|---------|---|--------------------------------------------------------------------|---------|---|----------------------------------------------------------------|------|---|---------------------------------------------------------------|------|---|----------------------------------------------------------------------------------|------|
| <b>B. 检索领域</b><br>检索的最低限度文献(标明分类系统和分类号)<br>H04N19/-;H04N7/-<br><br>包含在检索领域中的除最低限度文献以外的检索文献<br><br>在国际检索时查阅的电子数据库(数据库的名称, 和使用的检索词(如使用))<br>USTXT;EPTXT;CNTXT;CNABS;WOTXT;VEN;CNKI:编码, 变换矩阵, 残差, 码流, 率失真, 组合, 行变换, 列变换, 选择标记, code, transformation matrix, residual, code stream, rate distortion, combination, row transform, column transform, selection mark                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                  |                                             |      |                   |         |   |                                                                             |                 |   |                                                                             |         |   |                                                                    |         |   |                                                                |      |   |                                                               |      |   |                                                                                  |      |
| <b>C. 相关文件</b> <table border="1"> <thead> <tr> <th>类 型*</th> <th>引用文件, 必要时, 指明相关段落</th> <th>相关的权利要求</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>CN 102045560 A (华为技术有限公司等) 2011年 5月 4日 (2011 - 05 - 04)<br/>说明书第65-99段及图1-15</td> <td>1-6、11-14、16-19</td> </tr> <tr> <td>Y</td> <td>CN 102045560 A (华为技术有限公司等) 2011年 5月 4日 (2011 - 05 - 04)<br/>说明书第65-99段及图1-15</td> <td>7-10、15</td> </tr> <tr> <td>Y</td> <td>CN 102301707 A (汤姆森特许公司) 2011年 12月 28日 (2011 - 12 - 28)<br/>说明书第95段</td> <td>7-10、15</td> </tr> <tr> <td>A</td> <td>CN 102281435 A (华为技术有限公司) 2011年 12月 14日 (2011 - 12 - 14)<br/>全文</td> <td>1-19</td> </tr> <tr> <td>A</td> <td>CN 101609681 A (北京工业大学等) 2009年 12月 23日 (2009 - 12 - 23)<br/>全文</td> <td>1-19</td> </tr> <tr> <td>A</td> <td>KR 20120033951 A (KOREA ELECTRONICS TELECOMM) 2012年 4月 9日 (2012 - 04 - 09)<br/>全文</td> <td>1-19</td> </tr> </tbody> </table> |                                                                                  |                                             | 类 型* | 引用文件, 必要时, 指明相关段落 | 相关的权利要求 | X | CN 102045560 A (华为技术有限公司等) 2011年 5月 4日 (2011 - 05 - 04)<br>说明书第65-99段及图1-15 | 1-6、11-14、16-19 | Y | CN 102045560 A (华为技术有限公司等) 2011年 5月 4日 (2011 - 05 - 04)<br>说明书第65-99段及图1-15 | 7-10、15 | Y | CN 102301707 A (汤姆森特许公司) 2011年 12月 28日 (2011 - 12 - 28)<br>说明书第95段 | 7-10、15 | A | CN 102281435 A (华为技术有限公司) 2011年 12月 14日 (2011 - 12 - 14)<br>全文 | 1-19 | A | CN 101609681 A (北京工业大学等) 2009年 12月 23日 (2009 - 12 - 23)<br>全文 | 1-19 | A | KR 20120033951 A (KOREA ELECTRONICS TELECOMM) 2012年 4月 9日 (2012 - 04 - 09)<br>全文 | 1-19 |
| 类 型*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 引用文件, 必要时, 指明相关段落                                                                | 相关的权利要求                                     |      |                   |         |   |                                                                             |                 |   |                                                                             |         |   |                                                                    |         |   |                                                                |      |   |                                                               |      |   |                                                                                  |      |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | CN 102045560 A (华为技术有限公司等) 2011年 5月 4日 (2011 - 05 - 04)<br>说明书第65-99段及图1-15      | 1-6、11-14、16-19                             |      |                   |         |   |                                                                             |                 |   |                                                                             |         |   |                                                                    |         |   |                                                                |      |   |                                                               |      |   |                                                                                  |      |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | CN 102045560 A (华为技术有限公司等) 2011年 5月 4日 (2011 - 05 - 04)<br>说明书第65-99段及图1-15      | 7-10、15                                     |      |                   |         |   |                                                                             |                 |   |                                                                             |         |   |                                                                    |         |   |                                                                |      |   |                                                               |      |   |                                                                                  |      |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | CN 102301707 A (汤姆森特许公司) 2011年 12月 28日 (2011 - 12 - 28)<br>说明书第95段               | 7-10、15                                     |      |                   |         |   |                                                                             |                 |   |                                                                             |         |   |                                                                    |         |   |                                                                |      |   |                                                               |      |   |                                                                                  |      |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | CN 102281435 A (华为技术有限公司) 2011年 12月 14日 (2011 - 12 - 14)<br>全文                   | 1-19                                        |      |                   |         |   |                                                                             |                 |   |                                                                             |         |   |                                                                    |         |   |                                                                |      |   |                                                               |      |   |                                                                                  |      |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | CN 101609681 A (北京工业大学等) 2009年 12月 23日 (2009 - 12 - 23)<br>全文                    | 1-19                                        |      |                   |         |   |                                                                             |                 |   |                                                                             |         |   |                                                                    |         |   |                                                                |      |   |                                                               |      |   |                                                                                  |      |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | KR 20120033951 A (KOREA ELECTRONICS TELECOMM) 2012年 4月 9日 (2012 - 04 - 09)<br>全文 | 1-19                                        |      |                   |         |   |                                                                             |                 |   |                                                                             |         |   |                                                                    |         |   |                                                                |      |   |                                                               |      |   |                                                                                  |      |
| <input type="checkbox"/> 其余文件在C栏的续页中列出。 <input checked="" type="checkbox"/> 见同族专利附件。                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                  |                                             |      |                   |         |   |                                                                             |                 |   |                                                                             |         |   |                                                                    |         |   |                                                                |      |   |                                                               |      |   |                                                                                  |      |
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| 国际检索实际完成的日期<br><br>2019年 10月 14日                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                  | 国际检索报告邮寄日期<br><br>2019年 11月 1日              |      |                   |         |   |                                                                             |                 |   |                                                                             |         |   |                                                                    |         |   |                                                                |      |   |                                                               |      |   |                                                                                  |      |
| ISA/CN的名称和邮寄地址<br>中国国家知识产权局(ISA/CN)<br>中国北京市海淀区蓟门桥西土城路6号 100088<br>传真号 (86-10)62019451                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                  | 受权官员<br><br>夏雪<br><br>电话号码 86-(20)-28950718 |      |                   |         |   |                                                                             |                 |   |                                                                             |         |   |                                                                    |         |   |                                                                |      |   |                                                               |      |   |                                                                                  |      |

国际检索报告  
关于同族专利的信息

国际申请号

PCT/CN2019/075468

| 检索报告引用的专利文件 |             |   |               | 公布日<br>(年/月/日) |              | 同族专利 | 公布日<br>(年/月/日) |
|-------------|-------------|---|---------------|----------------|--------------|------|----------------|
| CN          | 102045560   | A | 2011年 5月 4日   | CN             | 102045560    | B    | 2013年 8月 7日    |
|             |             |   |               | US             | 2012201303   | A1   | 2012年 8月 9日    |
|             |             |   |               | KR             | 20120060914  | A    | 2012年 6月 12日   |
|             |             |   |               | AU             | 2010310286   | B2   | 2014年 5月 1日    |
|             |             |   |               | WO             | 2011047579   | A1   | 2011年 4月 28日   |
|             |             |   |               | BR             | 112012011325 | A2   | 2016年 4月 19日   |
|             |             |   |               | KR             | 101481642    | B1   | 2015年 1月 22日   |
|             |             |   |               | EP             | 2493197      | A4   | 2014年 7月 16日   |
|             |             |   |               | BR             | 112012011325 | B1   | 2019年 4月 30日   |
|             |             |   |               | US             | 9723313      | B2   | 2017年 8月 1日    |
|             |             |   |               | EP             | 2493197      | A1   | 2012年 8月 29日   |
|             |             |   |               | AU             | 2010310286   | A1   | 2012年 6月 14日   |
|             |             |   |               | IN             | 201203557    | P4   | 2013年 8月 2日    |
| CN          | 102301707   | A | 2011年 12月 28日 | KR             | 101834825    | B1   | 2018年 3月 6日    |
|             |             |   |               | EP             | 2382778      | A4   | 2012年 8月 15日   |
|             |             |   |               | EP             | 2382778      | A1   | 2011年 11月 2日   |
|             |             |   |               | KR             | 20170118956  | A    | 2017年 10月 25日  |
|             |             |   |               | KR             | 20110106403  | A    | 2011年 9月 28日   |
|             |             |   |               | WO             | 2010087809   | A1   | 2010年 8月 5日    |
|             |             |   |               | JP             | 2012516627   | A    | 2012年 7月 19日   |
|             |             |   |               | BR             | PI0924155    | A2   | 2016年 10月 4日   |
|             |             |   |               | US             | 2011268183   | A1   | 2011年 11月 3日   |
|             |             |   |               | US             | 9161031      | B2   | 2015年 10月 13日  |
|             |             |   |               | CN             | 102301707    | B    | 2015年 12月 2日   |
| CN          | 102281435   | A | 2011年 12月 14日 | CN             | 102281435    | B    | 2013年 10月 2日   |
|             |             |   |               | WO             | 2011153888   | A1   | 2011年 12月 15日  |
| CN          | 101609681   | A | 2009年 12月 23日 | CN             | 101609681    | B    | 2012年 4月 4日    |
| KR          | 20120033951 | A | 2012年 4月 9日   |                | 无            |      |                |