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(54) **Title:** METHODS AND SYSTEMS FOR OPTIMIZATION PROBLEM TRANSFORMATION FOR FACILITATED RESOLUTION

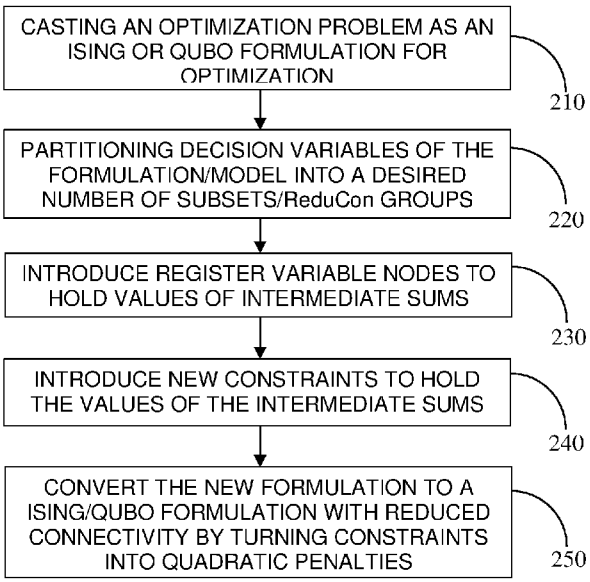


FIG. 2

(57) **Abstract:** Methods and system for transformation of an optimization problems to facilitate its resolution are provided. According to at least one aspect of the present embodiments, a method includes casting the optimization problem into a quadratic unconstrained binary model and transforming the optimization problem into an optimization problem in the same model but with reduced connectivity. Transforming the optimization problem into the optimization problem with reduced connectivity includes partitioning decision variables in the quadratic unconstrained binary model into two or more groups, each of the two or more groups comprising at least one decision variable node and introducing a register variable node between adjacent pairs of the at least one decision variable node in the two or more groups to hold partial values of a sum in a linear constraint to form the optimization problem with reduced connectivity.

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A. CLASSIFICATION OF SUBJECT MATTER

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According to International Patent Classification (IPC)

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G06N

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)

Fampat and Google Scholar: quadratic unconstrained binary optimization, QUBO, 二次无约束二值优化, quantum computing, 量子计算, partition, cluster, group, 分组, 划分, adjacent pairs, adjacent variables, introduce/add/new variable, reduced/less/loose connectivity, less interaction, linear constraint, Houdayer move, Ising problem and other related terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	A. Vandenbroucque, A Dive into Cluster Monte-Carlo Algorithms, *Master's Thesis*. 3 September 2021 [Retrieved on 2023-09-20 from https://adrienvdb.com/wp-content/uploads/2021/11/master_thesis_adrien_vandenbroucque.pdf] Section 4.3.3	-
A	M. SAMORANI ET AL., Clustering-driven evolutionary algorithms: an application of path relinking to the quadratic unconstrained binary optimization problem. *Journal of Heuristics*, 1 January 2019 [Retrieved on 2023-09-20] <DOI: HTTPS://DOI.ORG/10.1007/S10732-018-9403-Z>	-
A	US 2015/0193692 A1 (R. ISRAEL) 9 January 2015	-
A	US 2016/0321559 A1 (G. ROSE ET AL.) 3 November 2016	-

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2015/0193692 A1	09/07/2015	NONE	
US 2016/0321559 A1	03/11/2016	NONE	