



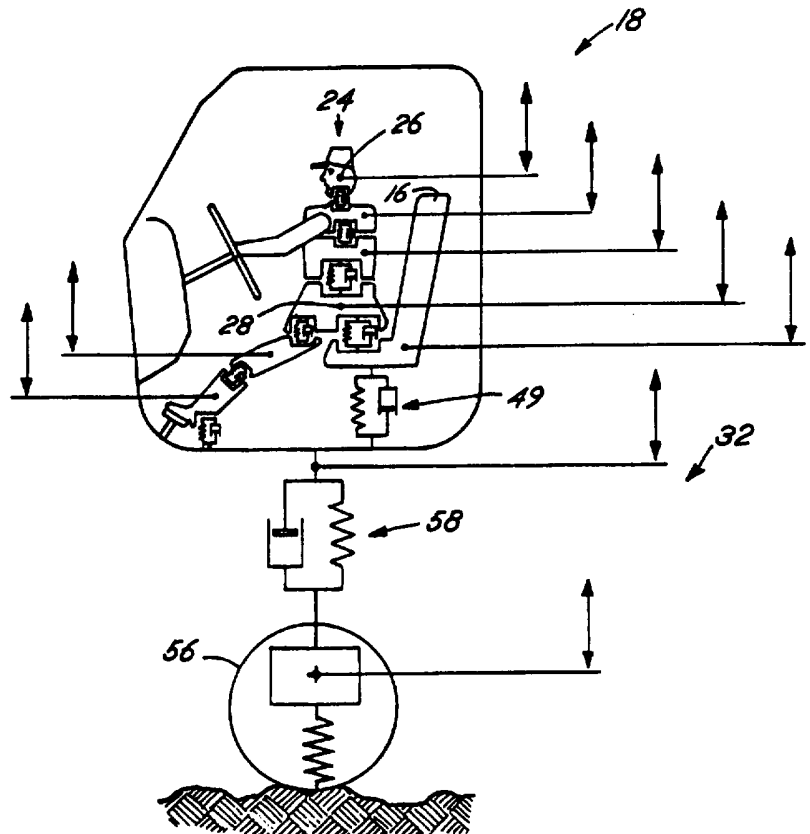
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁶ : B60N 2/50</p>	<p>A3</p>	<p>(11) International Publication Number: WO 96/14220 (43) International Publication Date: 17 May 1996 (17.05.96)</p>
<p>(21) International Application Number: PCT/US95/14166 (22) International Filing Date: 3 November 1995 (03.11.95) (30) Priority Data: 08/334,153 4 November 1994 (04.11.94) US (71) Applicant: BOARD OF TRUSTEES OF THE UNIVERSITY OF ILLINOIS [US/US]; 352 Henry Administration Building, 506 South Wright Street, Urbana, IL 61801 (US). (72) Inventor: AMIROUCHE, Farid, M., L.; 750 Broadview Avenue, Highland Park, IL 60053 (US). (74) Agents: AARONSON, Lawrence, H. et al.; Banner & Allegretti, Ltd., Ten South Wacker Drive, Chicago, IL 60606 (US).</p>	<p>(81) Designated States: CA, JP, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> (88) Date of publication of the international search report: 27 June 1996 (27.06.96)</p>	

(54) Title: SEAT SUSPENSION SYSTEM USING HUMAN BODY RESPONSES

(57) Abstract

An active seat suspension system for equipment that transfers vibration to a human operator. The system provides human body vibration control and, thus, a more comfortable environment for the operator. The system utilizes a "man in a loop" control strategy, where both the equipment and human operator model are analyzed as a dynamic system. The seat suspension parameters are evaluated through optimization, which assumes, under normal stochastic conditions, that the vibratory inputs to the system are unknown. A controller estimates their values in real time, and a preferred characteristic force between the seat and machinery is determined. The characteristic force determined minimizes a cost function. Using an output from the controller, an actuator (which may be either active or semi-active) substantially applies the characteristic force between the seat and machinery, resulting in reduced vibration being transmitted to the human operator.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	GB	United Kingdom	MR	Mauritania
AU	Australia	GE	Georgia	MW	Malawi
BB	Barbados	GN	Guinea	NE	Niger
BE	Belgium	GR	Greece	NL	Netherlands
BF	Burkina Faso	HU	Hungary	NO	Norway
BG	Bulgaria	IE	Ireland	NZ	New Zealand
BJ	Benin	IT	Italy	PL	Poland
BR	Brazil	JP	Japan	PT	Portugal
BY	Belarus	KE	Kenya	RO	Romania
CA	Canada	KG	Kyrgystan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LI	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LU	Luxembourg	TD	Chad
CS	Czechoslovakia	LV	Latvia	TG	Togo
CZ	Czech Republic	MC	Monaco	TJ	Tajikistan
DE	Germany	MD	Republic of Moldova	TT	Trinidad and Tobago
DK	Denmark	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	US	United States of America
FI	Finland	MN	Mongolia	UZ	Uzbekistan
FR	France			VN	Viet Nam
GA	Gabon				

INTERNATIONAL SEARCH REPORT

Inter. Application No
PCT/US 95/14166

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B60N2/50

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)
IPC 6 B60N

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 practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO,A,91 04168 (STURHAN KLAUS ;ISRINGHAUSEN GEB (DE)) 4 April 1991 see page 6, line 18 - page 9, line 15; figure 1 ---	1,5
A	EP,A,0 048 604 (DEERE & CO) 31 March 1982 ---	
A	US,A,4 505 513 (BARLEY GEOFFREY W) 19 March 1985 ---	
A	JOURNAL OF SOUND & VIBRATION, vol. 123, no. 2, 1 January 1988, pages 281-292, XP000563042 AMIROUCHE F M L ET AL: "SIMULATION AND ANALYSIS OF A BIODYNAMIC HUMAN MODEL SUBJECTED TO LOW ACCELERATIONS A CORRELATION STUDY" cited in the application ---	
	-/--	

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

22 April 1996

Date of mailing of the international search report

0 2. 05. 96

Name and mailing address of the ISA
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl,
Fax (+ 31-70) 340-3016

Authorized officer

Horvath, R

INTERNATIONAL SEARCH REPORT

Inter. onal Application No
PCT/US 95/14166

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>JOURNAL OF SOUND & VIBRATION, vol. 56, 1 January 1989, pages 55-115, XP000562975 MCLEOD R W ET AL: "A REVIEW OF THE EFFECTS OF TRANSLATIONAL WHOLE-BODY VIBRATION ON CONTIUNUOUS MANUAL CONTROL PERFORMANCE" cited in the application -----</p>	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 95/14166

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A-9104168	04-04-91	DE-A- 3930612	21-03-91
		AT-T- 130256	15-12-95
		AU-B- 629995	15-10-92
		AU-B- 6504890	18-04-91
		CA-A- 2041645	14-03-91
		DE-D- 59009884	21-12-95
		EP-A- 0443022	28-08-91
		JP-T- 4503343	18-06-92
		US-A- 5272633	21-12-93
EP-A-0048604	31-03-82	US-A- 4363377	14-12-82
		AT-T- 8026	15-07-84
		AU-B- 542167	07-02-85
		AU-B- 7551581	01-04-82
		CA-A- 1170336	03-07-84
		JP-A- 57087724	01-06-82
US-A-4505513	19-03-85	NONE	