

Human Factors Research Unit

Institute of Sound and Vibration Research
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AIMS

To conduct fundamental and applied research, provide training and offer advice in matters related to human responses to vibration. Research areas include effects of whole-body vibration, hand-transmitted vibration, and motion sickness.

FACILITIES

Motion simulation laboratory

Vibrators for human experimentation: six-axis motion simulator (1-m vertical, 0.5-m horizontal, > 20 degrees roll, pitch and yaw), 1-m hydraulic vertical vibrator; 1-m hydraulic horizontal vibrator; facilities for separate roll, pitch and yaw oscillation; motion simulator with 12-m horizontal motion and 10° roll; wide range of electrodynamic vibrators with strokes up to 50 mm.

Computer software and hardware

HVLab data acquisition and analysis systems for generating signals, acquisition and analysis of time series data, including the real-time control of vibrators in experiments. Statistical and dynamic analysis software.

Human Vibration Library

Collection of more than 18,000 publications concerned with human responses to vibration.

RESEARCH: HAND-TRANSMITTED VIBRATION

Physiological studies

Experimental studies of physiological responses to hand-transmitted vibration, including effects on blood flow, finger temperature and finger systolic blood pressure; vibrotactile and thermal thresholds.

Diagnosis of disorders

Development of techniques for the diagnosis of vascular and neurological disorders caused by hand-transmitted vibration. Standardisation of diagnostic techniques. Investigations of the sensitivity and specificity of objective indicators of disorder. Investigations of the repeatability of diagnostic methods. Determination of normal values for objective indicators of disease caused by hand-transmitted vibration.

Production of hardware and software for *HVLab* diagnostic systems (vibrotactile perception meter, thermal aesthesiometer, multi-channel plethysmograph, and finger rewarming system); support to users of *HVLab* systems.

Assessment of patients referred for diagnosis of disorders caused by hand-transmitted vibration.

Epidemiological studies

Studies of the relation between occupational exposures to hand-transmitted vibration and the development of signs and symptoms of disorder.

Psychological studies

Subjective responses to hand-transmitted vibration, including vibration discomfort and absolute thresholds and difference thresholds for vibration of the hand and foot.

Biodynamic studies

Biodynamic responses to hand-transmitted vibration, including measures of apparent mass, transmissibility, and dynamic modelling.

Assessment of the transmission of vibration through gloves and the development of methods of measuring, evaluating, and assessing glove performance.

Field studies

Measurement, evaluation, and assessment of occupational exposures to hand-transmitted vibration according to current and past standards.

RESEARCH: WHOLE-BODY VIBRATION

Comfort

Fundamental studies of effects of sinusoidal, random and multi-axial vibration and shocks on comfort. Development of techniques for evaluating complex motions (e.g., frequency weightings, vibration dose value). Applied studies involving the simulation of recorded vehicle, boat and aircraft vibration.

Performance

Fundamental studies of mechanisms involved in the effects of vibration on input processes (vision), central processes, and output processes (manual control). Applied studies of displays and controls for specific environments and the production of design guides.

Studies with helmet-mounted displays, helmet-mounted sights and other aspects of virtual displays and controls, including eye-controlled systems.

Effects of floor motion on stability of standing persons. Interaction between walking and floor motion.

Health

Epidemiological studies identifying the role of whole-body vibration in the development of back pain. Physiological responses to vibration and motion, including the response of back muscles to vibration and sitting posture. Derivation of guidance for whole-body vibration from physiological, psychological and biodynamic responses to vibration.

Low magnitude vibration

Absolute and difference thresholds for perception of whole-body vibration. Laboratory and field studies to develop guidance for evaluating vibration in buildings. Response to combined vibration and other factors.

Biodynamic studies

Transmission of each of six axes of vibration to the head for both seated and standing persons. Mechanical impedance of seated persons in each of three translational axes. Effects of posture, seating conditions and other sources of inter-subject variability on the transmissibility and impedance of the body. Development of models of biodynamic responses.

Seating

Development of objective methods of measuring seating dynamics and predicting seat comfort. Laboratory and field assessments of the dynamic performance of seats. Development of indicators of seat vibration isolation efficiency (e.g., SEAT). Design guides for seats in specific environments.

Methods of predicting seat dynamic performance from measures of subject apparent mass and seat dynamic stiffness. Development of anthropodynamic dummies for seat testing without human subjects. Dynamic models of seats, including suspension seats.

Field studies

Measurement, evaluation, and assessment of vibration in road, rail, air and sea transport and buildings.

RESEARCH: MOTION SICKNESS

Laboratory studies

Experimental studies to investigate factors influencing motion sickness, including the direction, frequency, and magnitude of translational oscillation, rotational oscillation, and Coriolis stimulation.

Influence of vision, posture and individual characteristics on motion sickness.

Investigations of sickness and vection in stationary people caused by motion of the visual field.

Physiological responses to low frequency motions.

Field studies

Studies of motion causing sickness in sea vessels (ships, hovercraft, hydrofoil, oil rigs), land transport (rail and road) and aircraft. Studies of factors influencing sickness in road transport.

Development of methods of predicting motion sickness (e.g. motion sickness dose value).

Assessment of motions and shocks on boats, ships, oil rigs, and small boats.

PUBLICATIONS

Publications and further information:

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