A Study of Biodynamic Response of Standing Human Exposed to Vertical Vibration

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ABSTRACT

Propagation of vibration in the human body depends on many variables characterizing the source of vibration, the system “ source of vibration- human being ” and the organism itself. The body posture has been found to be predominant. It influences the surface of contact of men with the vibrating plane, the position of the spine, the degree of tension in different muscle groups of the trunk and extremities. Variations in body postures alter elastic and damping properties of the organism and determine the mutual position of mass within its area. Not only this lead to the change of resonances of body segments but it also results in substantial change of vibration transmission in particular frequency bands. Investigations have shown that dangerous risk of health and vibration discomfort of human body are given by the movement of the human when walking, running or jumping, which can exert dynamic loads on the human body and by long-lasting exposure to whole – body vibration which the effects and side effects of vibration could be very harmful and in some cases leads to permanent injuries like spinal injuries, low back pain, performance decrement, visual loses and speech impairment. In this thesis several lumped mass models were used to simulate the behaviour of the human body during vertical motion. And the lumped mass models include two-degree of freedom model (Griffin et al, 2003), three-degree of freedom model (Kim et al, 1994), four-degree of freedom model (Nigg et al, 1999), eight-degree of freedom model (Maryam et al, 2002) and fifteen-degree of freedom (Qassem et al, 1997) in this thesis. In addition, both periodic harmonic sinusoidal exercises such as walking, running and jumping rope etc., and non-periodic transient motion such as parachute landing, jumping and gymnastic landing etc. are studied in detail in this thesis. Force method has been used to obtain the differential equations of the model, which were solved using simulink toolbox of Mathematica software coincide with the appropriate damping and stiffness coefficients of human segments from the relative literatures. The purpose of this thesis was to investigate the injuries and comfort of human body which the propagation of vertical vibration to different parts of the body in relation to the posture at different exercises being selected. On the basis of the simulated results on assessment of the risk of injuries and comfort of human body under vertical motion should be possible.

Keywords : Biodynamic response, Standing, Vertical vibration, Injury, Comfort

Table of Contents

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