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DEVELOPMENT OF A GRIP FORCE DEPENDENT HAND-ARM VIBRATION MODEL

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SUMMARY

The driving-point mechanical impedance of the human hand-arm system is strongly dependent on the grip force and excitation frequency. In this study, the biodynamic response of the human hand-arm is characterized by three and four degree-of-freedom (DOF) linear and nonlinear mass excited model incorporating grip force dependence of the restoring and dissipative properties. The model parameters are identified by minimizing a constrained objective function comprising impedance magnitude and phase errors between the computed and measured target driving-point mechanical impedance characteristics. The target impedance values are established in the 10 to 1000 Hz frequency range from the measurements performed in the three orthogonal directions (x_h, y_h and z_h) using 2 x *g* peak acceleration sinusoidal excitation and different magnitudes of constant grip force ranging form 10 to 50 N. The linear and nonlinear models are analyzed to determine the driving-point mechanical impedance characteristics for different levels of grip force. The computed response characteristics are compared to the target values to demonstrate the validity of the proposed models. The results of the study revealed that the four-DOF nonlinear grip force dependent model yields good correlation with the measured response in all three directions, for the range of grip forces considered.

Key words: mechanical impedance, grip force, HAV model, nonlinear HAV model, parameter identification

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