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Modal Screw Axes

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ABSTRACT

The dynamic of a rigid body in space and subjected to elastic and kinematic restraints is considered.The motion of the system, under linearity assumptions, can be investigated by modal analysis. Modes and natural frequencies are intrinsic characteristics of the spectral vibration response. This paper is devoted to enlightening new modal features of a vibrating body: the identification of its screw axes. These axes are also intrinsic characteristics of the vibrating body. Their identification reveals in the vibratory response, the rigid body preferentially rotates about a specific axis for each mode. Different conditions emerge depending on the degrees of freedom available. In the planar motion, a proper rotation axis is identified. In a more general three-dimensional motion, each mode produces an intrinsic screw axis, about which the body rotates and translates simultaneously along its direction. This paper develops a modal screw axis theory relating the modal screw axes space placement to eigenvectors and eigenvalues and provides simulations for different body restraint conditions.