1988

Lumped Systems with Nonproportional Damping

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Title:	**LUMPED SYSTEMS WITH NONPROPORTIONAL DAMPING**
Year:	1988
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Abstract:	The time domain response of non-proportionally damped or non-classical normal mode or non-Rayleigh linear lumped parameter systems, as otherwise called, is derived. Modal analysis is used to transform the governing equations of motion to the respective natural coordinate space coupled equations. A decoupling process, using steady state properties, is presented. A criterion in the form of non-proportionality indices is developed, in order to measure the extent of the modal coupling and predict the error introduced in neglecting this coupling, either partially or completely. A specific application to a three degree of freedom system, with two closely spaced natural frequencies and moderate damping is given. Useful information about accuracy as well as the applicability of the proposed method over other relative ones is derived. The analysis is restricted to underdamped linear vibrating systems.