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# Nonlinear Responses of an Unbalanced Overhung Rotor-Short Journal Bearing System with Some Bifurcation Results

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**Abstract**. Both autonomous and non-autonomous nonlinear systems display complex responses including the transient and long run responses. An overhung rotor-short journal bearing system (ORSJB) is the excellent paradigm exhibiting nonlinear responses and of practical importance. The unbalanced overhung rotor-journal bearing system is formulated by using modified Laval-Jeffcott rotor model. The nonlinear fluid forces model of the short journal bearing is adopted and rearranged in suitable form for numerical analysis. This paper investigates numerically a bifurcation point, transient and long run responses of the ORSJB system. The rotational speed is preferable bifurcation parameter herein. The ORSJB system without unbalanced eccentricity for the selected parameters yields the bifurcation value of $\Omega = 3.0091$. Limits cycles in the long run responses with $e_U = 0.002\ m$ and without unbalanced eccentricity at long run are presented in the bifurcation regime at the speed of $\Omega = 6.6869$ and $\Omega = 0.01671$ respectively. The transient response with $e_U = 0.002\ m$ at the speed of $\Omega = 4.7142$ is elucidated. The evident results in this paper give only partial view of bifurcation behaviours. Bifurcation analysis is a useful tool for design and operation overhung rotordynamic systems.