

# MODELING, VERIFICATION, OPTIMAL DESIGN OF NONLINEAR VALVE SPRING

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## ABSTRACT

The objective of this study is the optimal design of helical spring based on dynamic criteria. The most important dynamic performance criterion of a helical spring is the resonance behavior, including dynamic stress, coil closing, and surge. In order to perform computer aided optimization, the construction of an accurate dynamic model is necessary. The more variables are considered as design variables, the more flexible and better designs are possible. More design variables are also making the description of dynamics more complex. In this study, predictive dynamic models for variable pitch angle, variable wire diameter, and variable spring radius are derived by fundamental mathematics and mechanics principles. These models are nonlinear partial differential equations, in general more complex than the well known and commonly used wave equation.