Development of a reduced-basis numerical continuation method
Funding agency: SERB (MATRICS Scheme)

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- **Theme:** Finite element (FE) analysis of structural nonlinear dynamics.
- **Objectives:** (a) Reduced-basis FE formulation of structural nonlinear dynamic problems, (b) development of a numerical continuation technique for solving nonlinear structural dynamics in FE framework.
- **Deliverables:** (a) Proper identification of basis vectors for reduced-order FE formulation, (b) Local stability analysis procedure using reduced-basis solution, (c) Order approximation in extrapolation technique involved in the numerical continuation, (d) Numerical continuation method for time-domain solution especially to reduce computational cost in global stability analysis.

- **Noteworthy aspects**: A successful development of this proposed method will provide a great tool for solution of nonlinear dynamic problems in FE framework. It can subsequently be used for the development of the FE based dynamic analysis software.

- **Achievements:** The project started in December 2020; however, in almost one year, the salient achievements are
  (a) A methodology is devised for proper identification of reduced basis vectors in the recued-order FE analysis of nonlinear dynamics of elastic and viscoelastic structures.
  (b) A method is developed and tested for the local stability analysis using reduced-basis solution.
  (c) A reduced-basis formulation for handling nonlinear dynamics of viscoelastic structures is developed.
  (d) The harmonic balance method is successfully implemented in conjunction with the fractional Zener constitutive model for solving nonlinear frequency responses of viscoelastic structures.
  (e) A new numerical continuation method is developed; however, the verification of its fruitfulness in solving nonlinear structural dynamics is in progress.