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Dynamic Sensitivity of a Multi-block Stack Subjected to Horizontal Harmonic Excitation

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Abstract

Many civil engineering structures can be considered as discrete, discontinuous systems with deliberate gaps or clearances ranging from simple dry stone walling or masonry to sophisticated complex geometry graphite cores in nuclear power plants. In spite of extraordinary advances in nonlinear computational mechanics, it is still difficult to define the highly nonlinear mechanical response of such systems even if some homogenization technique allows relevant dynamic characterization. The way we chose to explore and illustrate relevant observations is to study a one-dimensional model i.e. a row comprising N rigid blocks driven by harmonic excitation of the side boundaries, where the blocks are subject to dissipative collisions.
Here dynamic sensitivity of a one-dimensional stack of eight rigid blocks undergoing external harmonic vibrations is investigated. Several parameters are considered as dynamic block stack attributes: time variation of the mass inertia of the stack and for each block the average over all the simulation of granular temperature, relative velocity, coordination number. Numerical simulation is based on the Non Smooth Contact Dynamics (NSCD) time integration framework Solfec (http://code.google.com/p/solfec/). Sensitivity space parameters include a range of excitation frequencies and velocity amplitudes.