Gap Influence on Seismic Response of Piping

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This paper presents a theoretical and experimental study of the influence of the gaps on the seismic dynamic response of piping systems.
The paper is divided in three parts :
- the significant parameters are identified through a dimensional analysis
- dynamic time-history analyses are performed for a set of values of the parameters corresponding to the expected range
- experimental verification of the numerical results is performed through earthquake simulation on a shake table.

From the dimensional analysis and the numerical investigation, the following design method is proposed to take gaps into account in a modal spectral piping analysis :
- the true stiffness of the support is evaluated and introduced in the model
- beyond the broadening (15 p.c.) of the Reg. Guide 1.122, the applicable response spectrum is broadened in order to cover the uncertainty upon the first natural frequency of the piping
- dynamic stresses resulting from the modal spectral analysis are amplified with a factor depending upon the gap size
- loads on supports are used as obtained from the spectral analysis

The currently available experimental results compare fairly good with numerical predictions.