Reduced order modelling in vibration analysis of water-pipe system

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ABSTRACT

In buildings housing vibration-sensitive equipment, such as synchrotrons and large ground telescopes, strict requirements are stated regarding the vibration levels. Both external and internal vibration sources, for example traffic and indoor water-pumps, can influence the vibration levels in the buildings [1].

Water-pipe systems used for cooling purposes are often placed near vibration sensitive equipment in such buildings. The pipe systems transmit vibrations through structural parts to sensitive areas, possibly resulting in vibration levels exceeding the requirements. In order to avoid this, numerical prediction tools may be needed. Since large three-dimensional numerical models often are too large to be solved in a time-efficient manner, it may be necessary to employ reduced order modelling.

The vibrational response of pipe systems are investigated here by means of the finite element method, considering fluid-structure interaction [2]. The study presented here is focusing on techniques for reduced order modelling [3–5], such as component mode synthesis and interface reduction, in order to obtain a time-efficient numerical model that may be used for predicting vibration transmission.

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