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EVENT SIMULATION OF A THREE-DIMENSIONAL GUYED TOWER AND A REDUCED MODEL CONSTRUCTION

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Abstract. Antennas for communication (cellular phones, radio and TV broadcasting, data transmission, emergency systems, etc) are usually mounted on towers of different kinds. The supporting structure can be either a single solid mast, a lattice self-supported tower or a guyed tower. The extension of the population distribution and the increasing public opposition to install self-supported towers in the urban environments, make the guyed towers a structural type of extensive use. The latter are dealt with in the present work in a continuation of previous studies. Typically the guyed towers are comprised of a triangular lattice mast with several levels of guy arrangements. The guys are pre-stressed and the towers are very slender. The usual height range is about 60 m for cellular phone applications and more than 150 m for radio and TV transmissions. The cables play a significant role in the dynamic response of the tower. First a bibliographic review on the subject is included. Then, a particular configuration modeled in a commercial finite element method is presented. Truss 3D elements are employed and the cables are pre-stressed with different values of forces, depending on the level of the cable arrangements. A quasi-static wind load over the tower and the event of a guy rupture represent two possible actions on the tower. Also the influence on the dynamic response of different initial forces in the cables is analyzed. The addition of concentrated masses that represent the antenna devices are also considered in the analysis. Finally, a reduced model is constructed using the Karhunen-Loeve (KL) transformation. The methodology ensures that the KL bases found by this transformation (also known as Proper Orthogonal Decomposition) are the best representation of the dynamic of the structure for the given data. For linear problems, the bases are coincident with the normal vibration mode shapes. For nonlinear problems other functions are found with the advantage that there is a measure (the "energy" parameter) that indicates the percentage of information carried by each mode. Usually only a few of them capture a large part of the relevant dynamic. These bases are sometimes known as "nonlinear modes". The bases may be introduced in a Galerkin approximation that permits the construction of reduced models.