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Experimental Modal Analysis of Kursuncular Minaret

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Abstract : Minarets are tower like structures where the call to prayer of Muslims is performed. They have a symbolic meaning and sacred place among Muslims. Being tall and slender, they are prone to damage under earthquakes and strong winds. Kursuncular stone minaret was built around thirty years ago in Konya/TURKEY. Its core and helical stairs are made of reinforced concrete. Its stone spire was damaged during a light earthquake. Its spire is later replaced with a light material covered with lead sheets. In this study, the natural frequencies and mode shapes of Kursuncular minaret is obtained experimentally and analytically. First an ambient vibration test is carried out using a data acquisition system with accelerometers located at four locations along the height of the minaret. The collected vibration data is evaluated by operational modal analysis techniques. For the analytical part of the study, the dimensions of the minaret are accurately measured and a detailed 3D solid finite element model of the minaret is generated. The moduli of elasticity of the stone and concrete are approximated using the compressive strengths obtained by Windsor Pin tests. Finite element modal analysis of the minaret is carried out to get the modal parameters. Experimental and analytical results are then compared and found in good agreement.

Keywords : experimental modal analysis, stone minaret, finite element modal analysis, minarets
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