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New charts for rapid and accurate assessment of fundamental periods of concrete or steel buildings

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The evaluation of the fundamental period of vibration is a key element in calculating seismic forces. To be determined, designers can use two families of methods: those based on modal analysis using a finite elements modeling software and those based on the use of simplified formulas. The first usually allow a precise estimation of the fundamental period, but they happen to be too tedious for common buildings; furthermore, they are less suited to the first phases of design. The second are advantaged by their simplicity, but they are very imprecise and integrate a very limited number of parameters. Therefore, they don't truly allow to orient and optimize a building's design. The designers don't have the tools enabling to evaluate rapidly and precisely, during the first phases of design, the impact of their schemes on the intensity of seismic forces. Such a tool would also be useful in evaluation campaigns on seismic vulnerability of existing buildings. The tool presented here tends to respond to these needs. It consists of a series of charts meant to evaluate the fundamental periods of regular buildings one to fifteen stories high, in which the lateral-force-resisting system is composed of a moment-resisting frames (made of concrete or steel), a bearing wall system, or a dual system. They are based on n two-dimensional calculations realized with a FE modeling software. The parameters used to build the different case studies were then applied as variables in the charts themselves: number of levels, story height, use of the building, beam and floor average span, the length and thickness of reinforced concrete walls, mechanical properties of materials, the adherence to the strong column and weak beam concept. A validation campaign based on the comparison of theoretical curves using point clouds from experimental database is foreseen. These charts would then be meant to supersede simplified formulas. They do however already present an educational interest especially among students in architecture, for they allow to apprehend the impact of many design choices on the fundamental period, thus impacting seismic forces.