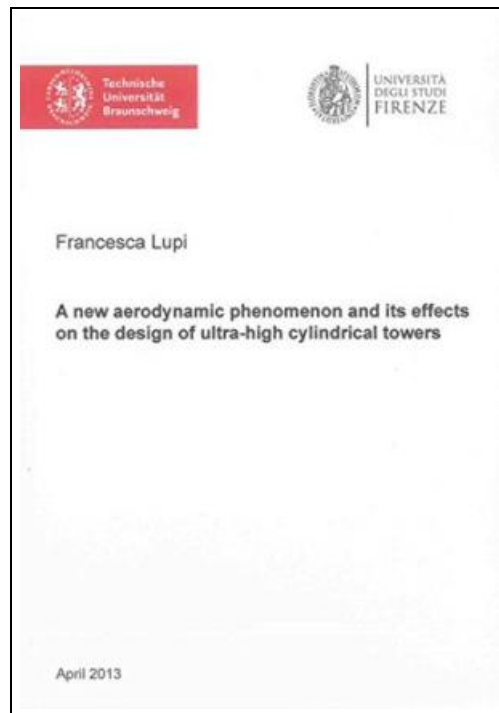


## A new aerodynamic phenomenon and its effects on the design of ultra-high cylindrical towers



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## A NEW AERODYNAMIC PHENOMENON AND ITS EFFECTS ON THE DESIGN OF ULTRA-HIGH CYLINDRICAL TOWERS



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Shaker Verlag Dez 2013, 2013. Taschenbuch. Condition: Neu. Neuware - The dissertation addresses the design of ultra-high towers in the atmospheric boundary layer under the wind action and has a special application for Solar Updraft Power Plants (SUPPs). They represent a highly sustainable natural resource for electric power generation, based on a combined sun-wind energy solution. The object of the investigation is a 1-km tall solar updraft tower, made of reinforced concrete and stiffened along the height by stiffening rings. Stiffening rings are usually introduced in the design of solar updraft towers in order to reduce their structural vulnerability to the wind action by enhancing a beam-like behaviour. However, wind tunnel experiments - which were performed for the first time on such a structure within this research - showed that the presence of ring beams along the height of the tower modifies the aerodynamics of the flow around the circular cylinder and creates a bi-stable and asymmetric load condition, which does not disappear even at moderately high Reynolds numbers. This phenomenon is new and unknown. Similar effects were observed around circular cylinders (without rings) in the critical range of the Reynolds number and around two side-by-side cylinders, but the conditions of occurrence and the physical reasons were profoundly different. The discovery of the existence of such a bi-stable and asymmetric load condition induced by ring beams along the height of a finite length circular cylinder, its interpretation, as well as the cross-checked experimental evidence in different wind tunnel laboratories confirmed also by numerical simulations, are the original contributions of this work. Then, the effect is quantified on the structural response. The bi-stable asymmetric load on the structure did not result to be a prohibitive load condition for solar updraft towers and the magnitude of the effect depends on the number and/or on the size of...



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