



Preface

The progressively unstable equilibrium of the leaning Tower of Pisa is due, and has been since 1174, to the phenomenon of the rigid rotation of its own axis in the north-south direction, because of the uneven subsidence of the foundation soil.

The problem has been examined by eminent scientists working in Soil Mechanics, and has been the subject matter of several theoretical studies, based only on geognostic research, in order to identify the geotechnical, physical and mechanical parameters of the soil. Unfortunately the comparison between a theoretical model of study and the real situation gives rise to complex and unavoidable divergences, due to the theoretical schematizations on which the static behavior of the building is based.

It is known, in fact, that the most current approximate hypothesis about the problems of the foundations technique considers the soil as a perfect elastic, homogeneous and isotropic means. So it is possible to establish a specific value for the critical height of the gravity center for each very tall building so that in the event of an external (even minor) perturbation, the building may overturn either because of instantaneous deformation (short-term instability) or due to delayed deformation, in the sense of slow and continuous inclination (long-term instability).

The collapse of the building as a consequence of the progressive increase of the gravity center eccentricity may also occur as a result of the crushing of its material, or due to the break-up of the soil, and also due to the concurrence of two of these phenomena or even of all the phenomena, including overturning.

The tower of Pisa is probably subject to the mechanism of long-term instability. The uncertainty surrounding the real behavior of the monument is due to the approximation of the theoretical model, which, if investigated with the proper caution, may give some indication about the real nature of the

instability of the building, whose rotation is estimated to be about $5^{\circ}30'$; in addition to this, since no real resolute intervention has been made in order to prevent the unavoidable collapse, an intervention technique is proposed in order to restore stability.

The first stage of the proposed operation consists of designing and laying a sub-foundation with specific typological characteristics able to limit (within admissible limits) the stress in the underlying foundation soil. Finally, in the second stage, the proposed technique makes possible to preserve or reduce the present inclination, as well as to restore perfect verticality and even, if desired, achieve counter-inclination.