Università degli Studi di Napoli Federico II

Scuola Politecnica e delle Scienze di Base

Dipartimento di Strutture per l'Ingegneria e l'Architettura (DiSt)

Nell'ambito del **Corso di Dottorato** in
Ingegneria Strutturale, Geotecnica e Rischio Sismico

6-22 settembre 2021, ore 15:00-17:00
(lunedì-mercoledì-venerdì)

Prof. Ing. Giuseppe Brandonisio
Dott. Ing. Francesco Marmo

Corso breve

Structural analysis of masonry arches and vaults

Masonry curved elements – such as arches, domes and vaults – represent one of the most widespread structural typologies in the historical buildings. Their stability is due to their shape and self-weight magnitude and distribution.

This course has the scope of introducing the main approaches for the analysis of their stability and safety and the design of repairing and strengthening interventions.

After a historical introduction on the typologies characterizing masonry curved structures, the traditional rules of art used in the past centuries for the design of the shape and of the geometry of the constitutive elements (arch thickness, buttress height and width, etc.) are discussed.

Both the classical and advanced analysis methods for arches and vaults are reviewed. Particular attention is devoted to the Limit Analysis (LA) approach based on the Heyman's assumptions for the masonry material.

Some of the main theories for modelling arches and vaults are presented. In particular the catenary equation, the theory of curved beams, the shell theory, the membrane theory of shells and the generalized eccentricity method are introduced as modelling tools for the analysis of arches and vaults. Then, some criteria for the assessment of the structural safety, both under vertical loads and under earthquake actions are discussed and applied to practical examples.

Finally, a vast part of the course is devoted to the Thrust Network Analysis (TNA) of masonry vaults, a computational technique for the limit analysis of masonry vaults subjected to both vertical and horizontal loadings. With this regard some case studies are presented regarding the analysis of real masonry arches and vaults. Finally, a MATLAB code that implements the specialization of the TNA to the case of planar arches is presented and discussed.

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