EXPERIMENTAL TECHNIQUES FOR STRUCTURAL IDENTIFICATION

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KEYWORDS: effective stress, effective strain, viscosity, Poisson ratio, HSC

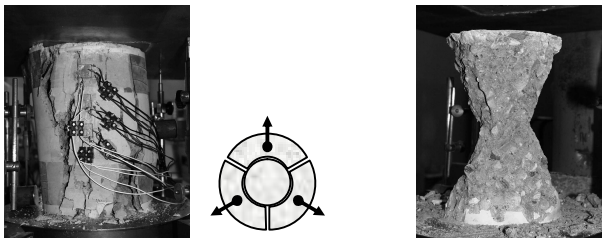

Fig.1 sub-vertical cracks on the surface and inner core

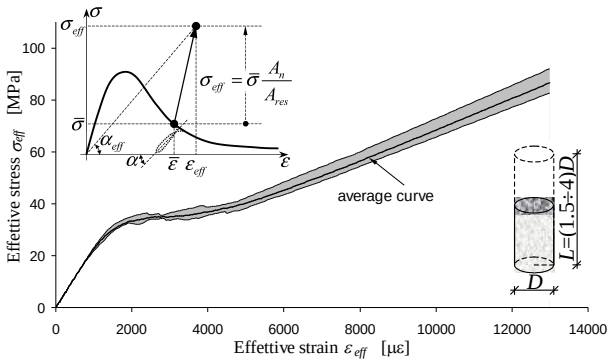

Fig.2 dispersion range of the effective law

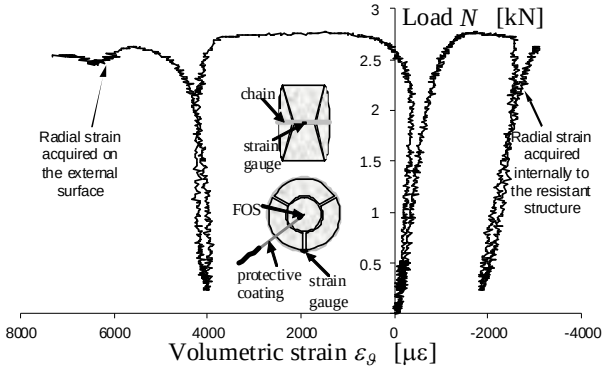

Fig.3 identification of ε_ϑ for different acquisitions of ε_r

A new experimental procedure for identifying the constitutive law in uniaxial compression has been proposed for brittle heterogeneous materials, the procedure of the effective law, which produces evidence against the existence of strain-softening and identifies a monotone strictly nondecreasing material law for concrete specimens in uniaxial compression, whose average stress versus average strain diagrams, $\bar{\sigma}-\bar{\varepsilon}$, are softening. The procedure is based on the idea that the actual failure mechanism develops internally, with macro-cracks propagating through the specimens from the very beginning of the compression test. In cylindrical specimens, these cracks isolate a resistant inner core of bi-conic shape, while the outer part is expelled along the radial direction and splits into several portions. At the end of the test, no evident crack propagation afflicts the bi-conic inner core. The sub-vertical cracks on the external surface are a secondary effect of the actual failure mechanism, which gradually modifies the resistant structure and, consequently, the actual cross-sectional area, or resistant area A_{res}, of the specimen.

The effective law is size-effect insensitive, since the dispersion range for specimens of different slenderness is very narrow. Other interesting results related to the identification procedure concern the Poisson's ratio, the volumetric strain, and the viscosity: it was found that the Poisson's ratio is almost independent of the longitudinal strain, concrete never exhibits dilatancy, and viscosity has no substantial effects on the macroscopic behaviour of concrete solids.

Moreover, the extension to HSC of the use of non destructive testing methods developed for normal strength concrete was evaluated.

Further research topics deal with the experimental application on structural shape control means of advanced materials and the application of high frequency stress waves for monitoring load in cables and to asses the strength of adhesively bonded joints.

Links

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MAIN PUBLICATIONS

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RESEARCH PROJECTS

- SMooHS – Smart Monitoring of Historical Structures, Unità di Bologna, European Research project ENV.2007.3.2.1.1.

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