

Report on the stay of M. Šilhavý
at Istituto di Scienza e Tecnologie dell'Informazione "A. Faedo"
under the Short-Term Mobility project
"Analisi dinamica di solidi elastici non lineari"

Date of arrival: 1 October 2006
Date of departure: 28 October 2006
Time effectively spent in the Institute: 4 weeks

The research dealt with the properties of partial differential equations of motion of masonry bodies with dissipation. Such bodies are treated as nonlinear elastic continua that cannot support tension, which results in several peculiarities of the corresponding equations of motion or equations of equilibrium. The following topics have been examined:

1. The existence and uniqueness theorem for the weak solution of the nonlinear dynamical problem for masonry bodies under time-dependent loads has been proved, using the theory of monotone operators. Possible types of dissipation have been assessed, including the nonlinear dissipation with a monotone response function.
2. The corresponding equilibrium problem has been examined, whose properties have consequences on the dynamical problem (see Item 3 below). In particular, it has been proved that the energy functional is bounded from below if and only if the loads are compatible, using the duality theory of Ekeland and Temam.
3. The relationship of the mentioned condition to the classical limit analysis has been established and consequences on the dynamical problem have been derived: It has been proved that if the loads are compatible then each initial perturbation of state decays in time and the body returns back to the equilibrium state while if the loads are incompatible then the evolution is catastrophic and the collapse of the structure occurs. The results provide a dynamical significance to the notion of collapse. Classical energy method has been employed.

The results will be used for the development of the numerical algorithms for the dynamical problem implemented in the code NOSA in realistic modellings of seismic loads, with consequences on the task of preserving architectural structures.

The results of the research are currently being compiled into a comprehensive paper to be published in an international journal.

As part of his activity, M. Šilhavý presented a talk on the dynamical problems for masonry bodies for the group of Mechanics of Materials and Structures at Istituto di Scienza e Tecnologie dell'Informazione "A. Faedo".

A further collaboration is planned.

M. Šilhavý declares the commitment to quote CNR in possible future scientific reports or publications directly resulting from the research activity carried out during the stay.

Prague, 2 November 2006

M. Šilhavý