

## **A time-dependent analysis of reinforced, prestressed and composite concrete plane frames**

**Franc Saje and Jože Lopatič**

*Faculty of Civil and Geodetic Engineering, University of Ljubljana, Jamova 2, SI-1000  
Ljubljana, SLOVENIA*

### **SUMMARY**

This paper deals with the method of computational analysis of the time-dependent response of concrete structures by taking rheology and gradual construction into account. The method of analysis developed is limited to plane frames that can be reinforced, prestressed or composed of steel and concrete. The analysis is based on the finite element method and performed step by step in different time intervals satisfying the strain compatibility, as well as equilibrium equations in cross-sections. In addition to the basic rheological influences, the geometrical non-linearity of the structures is also taken into consideration. Concrete creep is taken into account according to the linear theory. The influences of concrete ageing, shrinkage and creep are taken into account by the adequate constitutive law of concrete. The time-development of the creep function and shrinkage strain are based on the code-type prediction models. Losses of prestress caused by relaxation of prestressing steel are considered according to Stüssi's proposal. The simulation of gradual construction is carried out by the gradual changing of the structural system, and by adequate constitutive equations of layered cross-sections.

Based on the given theoretical derivations, a computer program for the analysis of the time dependent response of reinforced, prestressed and composite concrete plane frames was elaborated. On the computational examples the applicability of the prepared software is presented.

---