INTEGRATION OF MOTION EQUATIONS SYSTEMS IN DYNAMICAL ANALYSIS OF STRUCTURES

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For a dynamic system with more degree of freedom, as results from a finite element analysis of a mechanical mashed structure, dynamical motion equations form a differential equations system

$$[M]\{\ddot{U}\} + [C]\{\dot{U}\} + [K]\{U\} = \{F(t)\}, \tag{1}$$

with initial conditions $t = 0, \{U\} = \{U_0\}, \{\dot{U}\} = \{v_0\}$, where

- $[M]$, $[C]$, $[K]$ are mass matrix, dumping matrix and stiffness matrix, named *characteristic matrix* of system,
- $\{\ddot{U}\}$, $\{\dot{U}\}$, $\{U\}$, $\{F\}$, are displacement, velocity, acceleration and external forces vectors, written in the global coordinates system. The unknown values $\{U\}$ are time varying functions, $\{U\}=\{U(t)\}$, and generally represent longitudinal, transversal and rotations displacements.

Considering explicit or implicit presence of time variable t in expressions of $[M]$, $[C]$, $[K]$, according to the adopted dynamical model, it may be three distinct situations:

a) all elements of matrix coefficients are constants in time – *linear* systems;

b) some or all elements of matrix coefficients are time varying, variable t may have an implicit presence in expressions containing velocity or acceleration – *pseudo-linear* or *weak nonlinear* systems;

c) some or all elements of matrix coefficients depend of unknowns and their derivatives – *strong nonlinear* systems.

In this paper is suggested numerical approach to integrate motion equations expressed by second order differential equations systems in each of the mentioned situations.

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