

Real-ESSI Simulator System, Development History

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<http://real-essi.us/>

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Chapter 1

Development History

(1986-)

This section briefly describes history of the development of the Finite Element Interpreted, FEI, that is currently represented by the Real-ESSI Simulator system. Developments are presented chronologically, with very brief description of capabilities, and with references to further reading and documents with more information.

1986-1988: Development of the FRAME_and_GRID program, in 2D, using BASIC programming language, on SHARP 1500, CASIO 1000 (48KB RAM) and ZX Spectrum (128KB RAM), by Boris Jeremić, undergraduate student at the University of Belgrade.

1988-1989: Development of the Earthquake Soil Structure Interaction (ESSI) Program in time domain for axisymmetric solids with general 3D loads, using higher modes of response in circumferential direction, expanded in Fourier series, so that any general 3D loading and deformation can be modeled, earthquake shaking applied through "heavy" rock at the bottom of the model, using FORTRAN programming language, on PC-DOS, x286+287, 640KB+384KB RAM, by Boris Jeremić, undergraduate student at the University of Belgrade, as part of his Diploma Thesis ([Jeremić, 1989](#)).

1989-1992: Development of the Finite Element Interpreter (FEI), a general purpose static and dynamic, elastic and elastic-plastic finite element program for solids (3D), rudimentary parser for a simple Domain Specific Language (DSL), using C Programming language, on PC-DOS, x286+287, 640KB+384KB RAM, by Boris Jeremić, a staff engineer at (a) Energoprojekt-Hidroinžinering Company in Belgrade, Yugoslavia, at (b) Bekhme Dam Project site in Iraq, and at (c) Gasser&Scepan Design Bureau in Baar, Switzerland.

1992-1997: Development of the program FEM, featuring small and large deformation (large strain, large displacements/rotations), elasto-plasticity, solids (bricks with 8, 20 and 27 nodes), solution advancement control (hyperspherical/arc length control), using C++ Programming language, on Sun-SparcStation 5, Solaris, 256MB RAM, and on PC-DOS x386, x486 and on PC-Linux-TurboRedHat, by Boris Jeremić, a graduate student at the University of Colorado at Boulder, as part of his Master Thesis ([Jeremić, 1994](#)) and PhD Dissertation ([Jeremić, 1997](#)).

1997-2000: Continued development of the program FEM, addition of dynamics from ESSI, structural elements from FRAME_and_GRID, Parallel version, MPI based, linking with FEI, using C++ Programming

language, on PC-Linux, and PC-Linux cluster: [NorthCountry](#), 4 nodes + master, 100based T network, by Professor Boris Jeremić, at Clarkson University and at the University of California at Davis.

2000-2006: Developments continued with introduction of all the previous and new developments from FEM into G3 Framework, later renamed OpenSEES. at PEER, using C++ Programming language, on PC-Linux, by Professor Boris Jeremić and co-workers at the University of California at Davis, CA, USA, see [Final Report Presentation](#).

2006-Present: Development of the Real-ESSI Simulator System (aka Real-ESSI, MS-ESSI, NRC-ESSI), using C++, FORTRAN, FEI-DSL, Python Programming languages, on PC-Linux, by Professor Boris Jeremić and co-workers at UCD. For details see main [Real-ESSI Simulator web site](#) or/and [real-essi.us](#) or/and [real-essi.info](#) (they all point to the same URL),

Bibliography

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- B. Jeremić. Implicit integration rules in plasticity: Theory and implementation. Master's thesis, University of Colorado at Boulder, May 1994.
- B. Jeremić. *Finite Deformation Hyperelasto–Plasticity of Geomaterials*. PhD thesis, University of Colorado at Boulder, July 1997.