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SCALE EFFECT AND RADIAL OVERLOAD EARTH MODELS

Victor SHABUNEVICH[1]

ABSTRACT

This work is presented as a continuation of the author's papers [1, 2], in which numerous examples of dynamic calculations by the finite element method (FEM) is identical models of objects of different scale demonstrated the possibility of using various fruitful dynamic interpretation proposed by the author of the scale effect. In this work we show the importance of considering radial overloads in the dynamic analysis of Earth model.

INTRODUCTION

There are the results of calculations for Earth models with internal filling [1,2]. These models represent a spherical shell with radius 6.333 m, 6333 m and 6333 km and thicknesses of 0.21 m , 210 m and 210 km respectively. Within each model acts pressure 650000 Pa . Radius of the inner core models are respectively 3,475 m, 3475 m and 3475 km . Modulus of elasticity shell models is $7.0 \bullet 10^{10}$ Pa , its density is 2700 kg / m^3 . The space between the shell and the core fills the mantle . Adopted in the calculation of the elastic modulus of $7.0 \bullet 10^{7}$ Pa mantle , its density is 3700 kg / m^3 . Similarly, cores elastic modulus $7.0 \bullet 10^{10}$ Pa , the density of 13000 kg / m^3 . Mass models are respectively $5.45 \bullet 10^{6}$ kg, $5.45 \bullet 10^{15}$ kg and $5.45 \bullet 10^{24}$ kg. Main binding models is carried out in the centers of the nuclei. Type FE models presented in Figure 1.

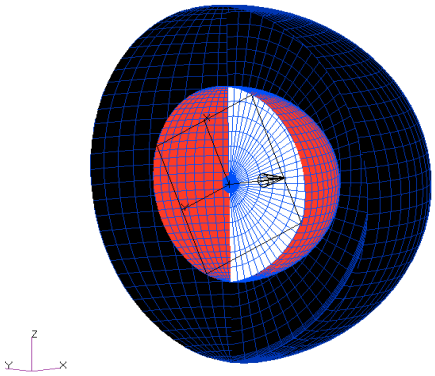
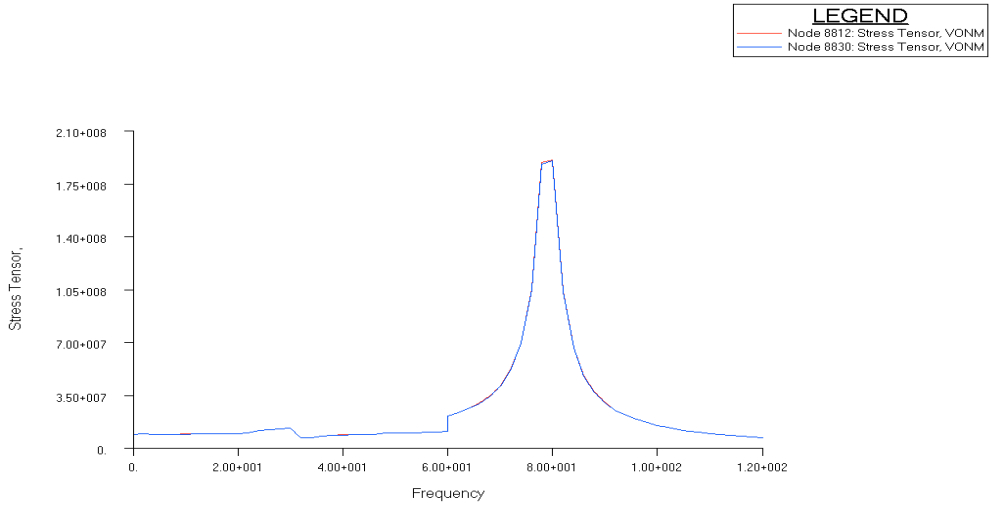


Figure 1. Filled FE model of the planet Earth

[1] "VNIIEM Corporation" JSC, Moscow, vniiem@vniiem.ru

We recall some results of harmonic analysis models [1]. Thus, when exposed to the shear force on the equator were prepared following the frequency changes, for example, the von Mises stress in the local area as necking in the equatorial region, spaced from the longitudinal shear force of 90 degrees.



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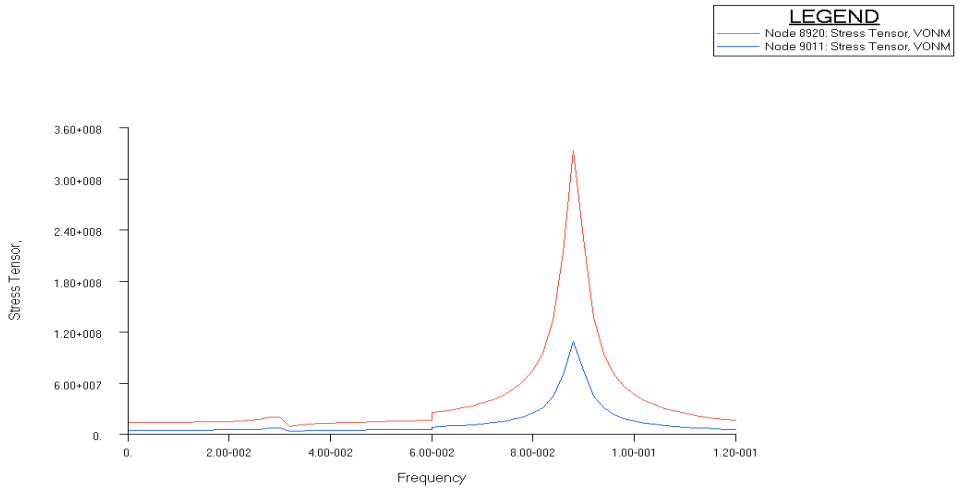

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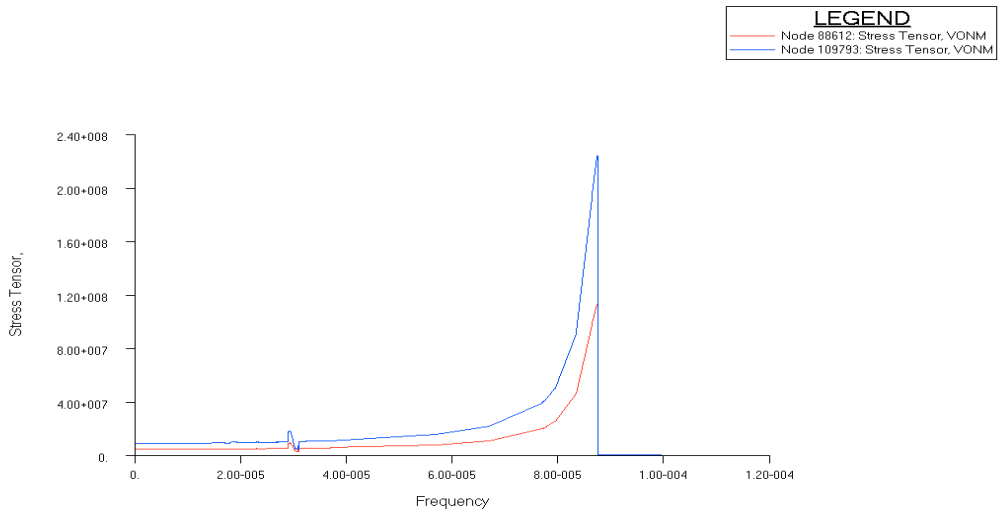

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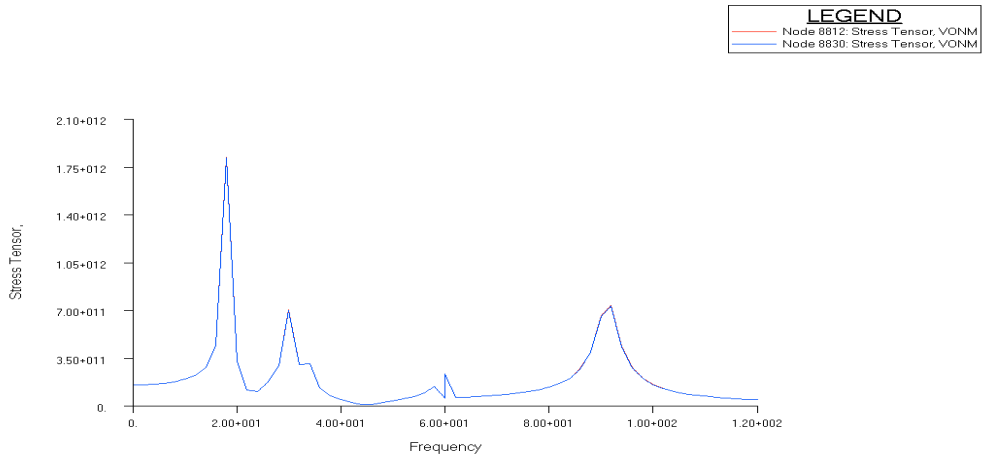
Figure 2. Change in frequency of Mises stress for small (a), medium (b) and large (c) models of the Earth under harmonic loading transverse force

Later in [2] shows similar results of calculations based on models of the Earth's rotation about its axis-scaled 0z, simulating the daily rotation of the Earth.



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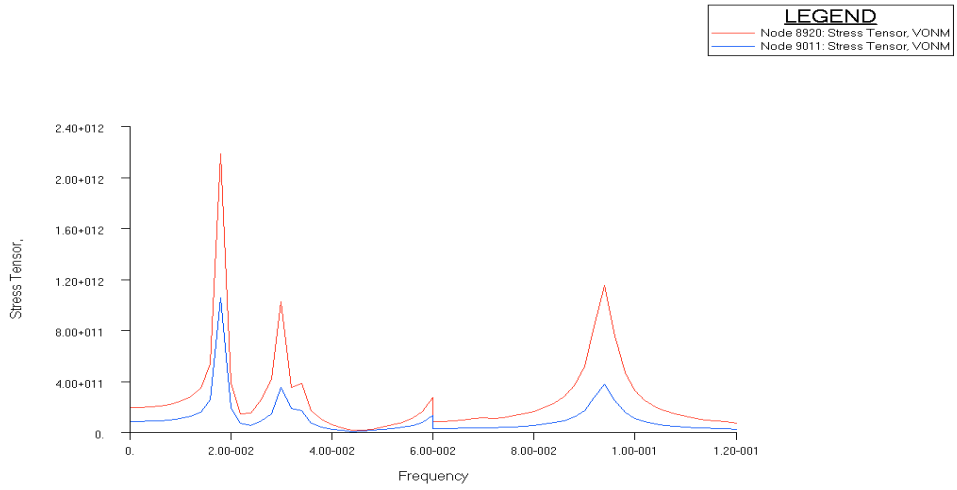

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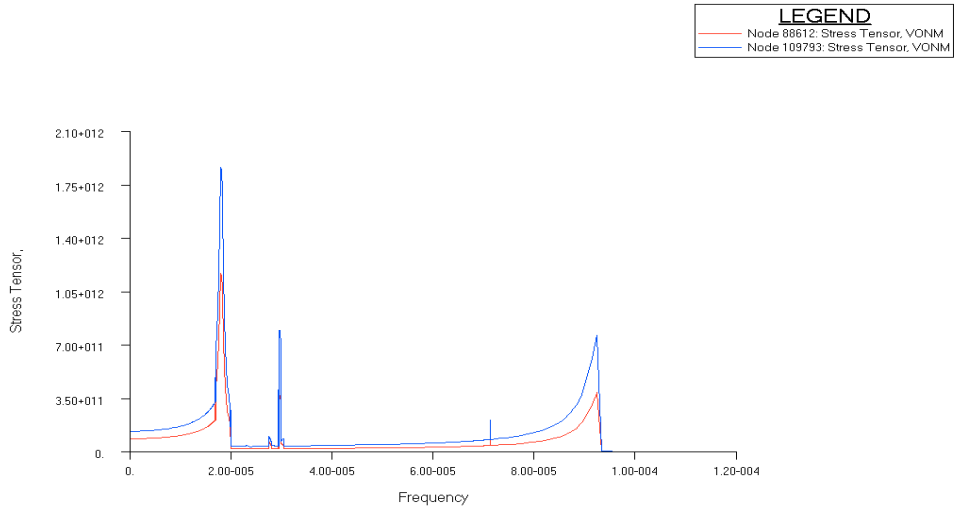

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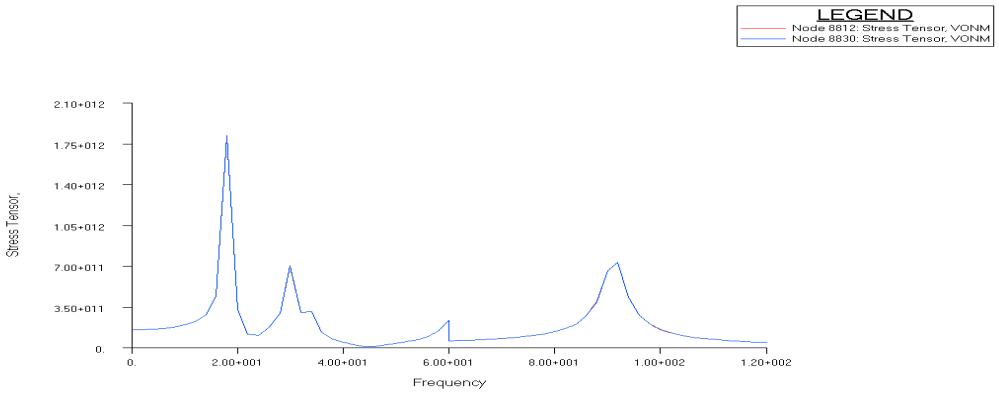
Figure 3. Change in frequency of Mises stress for small (a), medium (b) and large (c) Earth models with harmonic transverse force loading and rotation

In [3] shows similar results of calculations for different scale models of the Earth under the action of gravity and radial overload 1g. They clearly show a manifestation of the scale effect on the large size model of our planet.



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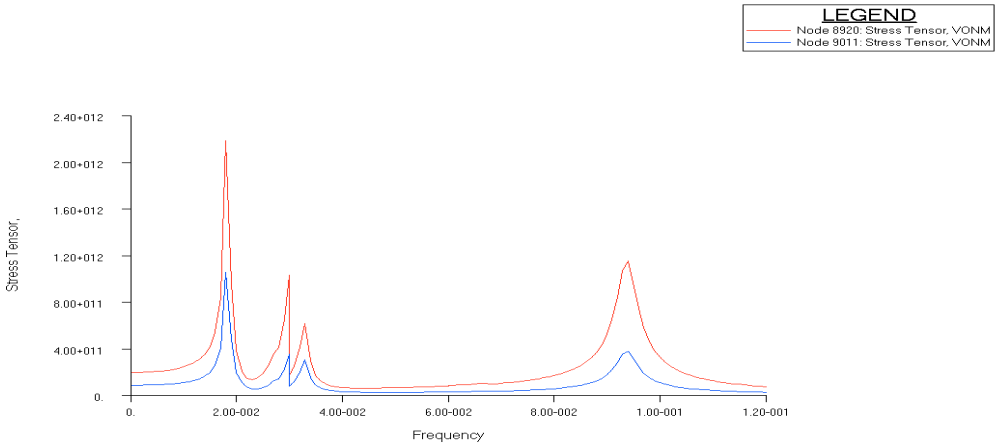

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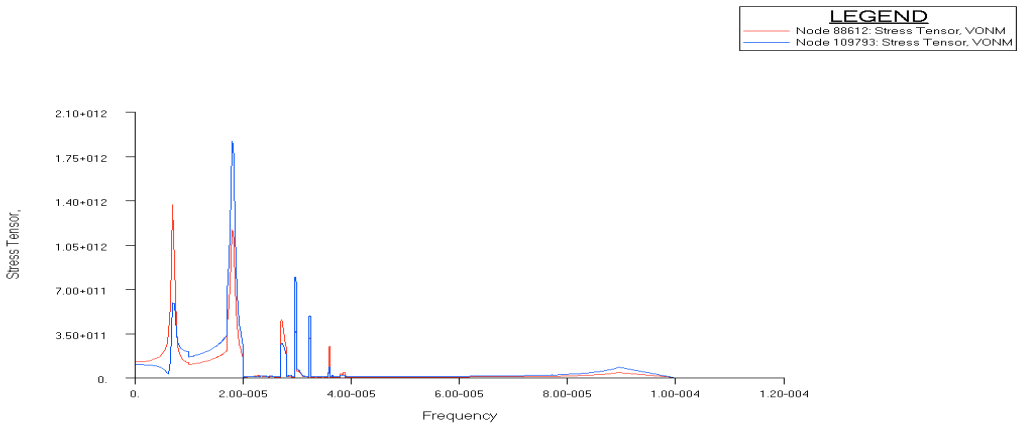

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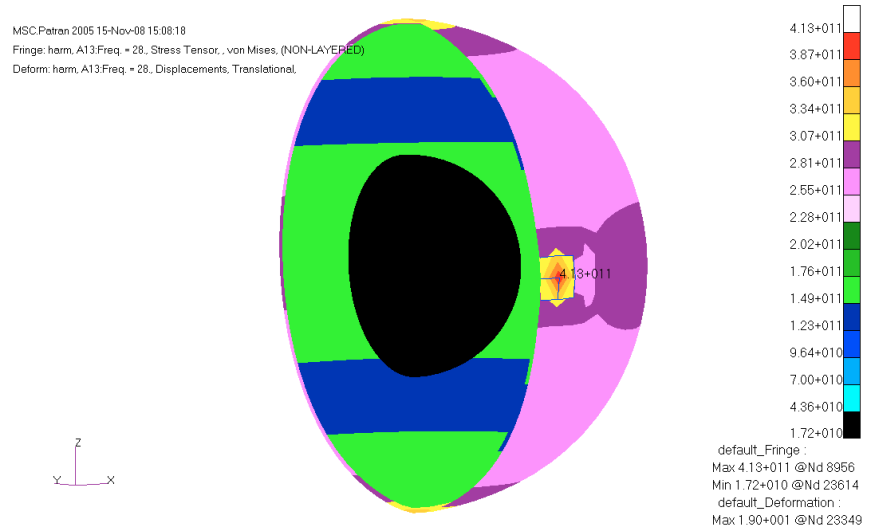
Figure 4. Change the frequency of Mises stress for small (a), medium (b) and large (c) Earth models with harmonic transverse force loading, rotation and radial overload 1g



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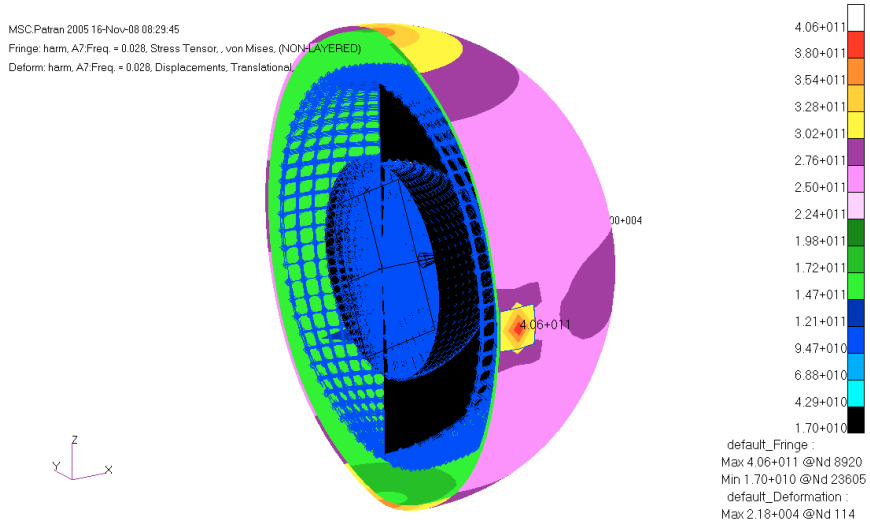

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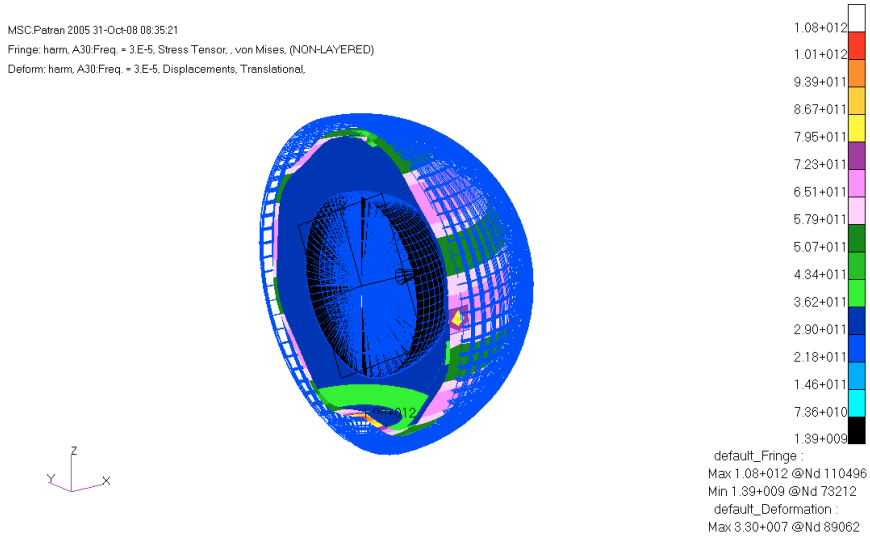

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Figure 5. Mises stress distribution (Pa) in a small model at 28 Hz (a), in the middle of the model at the frequency 0.028 Hz (b) and high frequency model 0.00003 Hz (c) the harmonic transverse force loading, rotation and radial overload 1g

CONCLUSIONS

The results of calculations of multiscale models of planet Earth are presented. Effect of radial accelerations on the lowest settings for small models of the Earth. For large models this effect is much larger. Besides of inversely proportional reducing the frequency of resonance peaks with increasing scale models the emergence of new major largest low-frequency resonance peaks happens.
Such manifestations of scale effect allow a deeper understanding of the essence of the phenomena taking place, such as the devastating earthquake .

REFERENCES

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