

Direct Finite Element Modeling of the Radiotelescope RT-70 Mechanics Borovkov A.I., Shevchenko D.V.

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The project is devoted to Finite Element (FE) analysis of topical problems (Fig.1):

- FE analysis of spatial (*3-D*) distribution of temperatures, displacements and thermal strains originating in radiotelescope *RT-70* under action of solar heating,
- FE analysis of *3-D* distribution of strains originating under action of gravity.
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Fig. 1

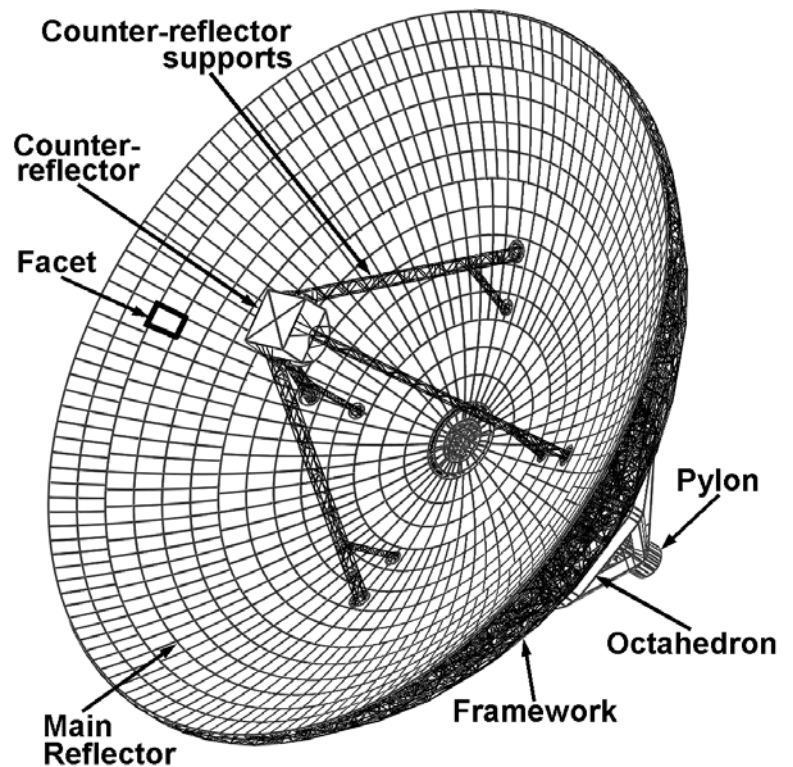
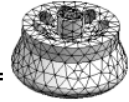


Fig. 2

During implementation of the project *3-D* FE models of the multi-gear antenna with main reflector of 70-meter diameter were developed. *3-D* FE models include four basic structural elements of the real object (Fig.2):

- Main reflector consisting of 1 188 facets – thin shells. All shells are divided along generatrix into 14 levels, as well as in circumferential direction: at the 1-*st* (upper row) and 2-*nd* levels – 144 facets, at 3-6 levels – 108 facets, at 7-11 levels – 72 facets, at 12-14 levels – 36 facets. The facets of every level



have different geometrical sizes, number of perforated stiffening ribs, etc. The facets are fastened to the framework by four jacks located in the corners of facets;

- Framework of the telescope consists of around 13 000 pipes with various diameters (around 10 basic standard sizes of pipes), connected by welding;
- Counter-reflector with supports – thin shell structure situated on beam supports;
- Octahedron with pylon – complex thin shell structure. Consideration of this structure allows to describe correctly behavior of the framework.

Characteristics of FE model developed for steady-state heat transfer analysis are presented in Table 1.

Table 1

Number of elements	
Shell	80 801
Link	78 928
Number of nodes	218 730
Number of degrees of freedom	218 730

Characteristics of FE model developed for thermoelastic analysis are presented in Table 2.

Table 2

Number of elements	
Shell	80 801
Beam	78 928
Number of nodes	218 730
Number of degrees of freedom	1 312 380

FE modeling and thermal and thermoelastic analysis of radiotelescope *RT-70* for climate environment corresponding to city of Eupatoria, Ukraine and Plateau Suffa, Uzbekistan.

Dependence between components of displacement vector and angle of radiotelescope slope relative to horizon (tilt angle). Displacement fields are estimated for all positions of radiotelescope.