



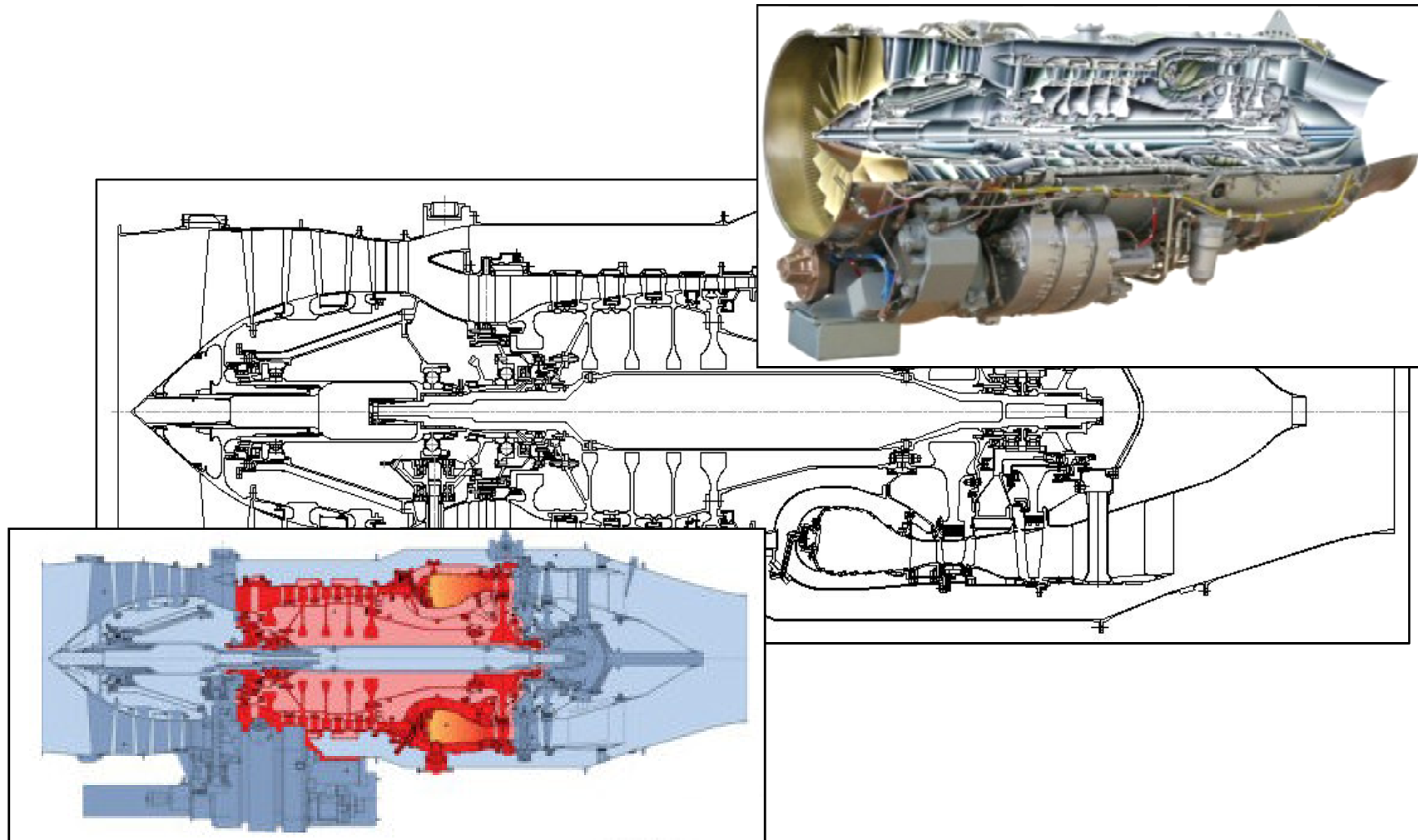
Twin-Shaft Gas-Turbine Engine - Modeling and Analysis

DYNAMICS R4

Alfa-Tranzit Co., Ltd



Twin-Shaft Gas-Turbine Engine



DYNAMICS R4

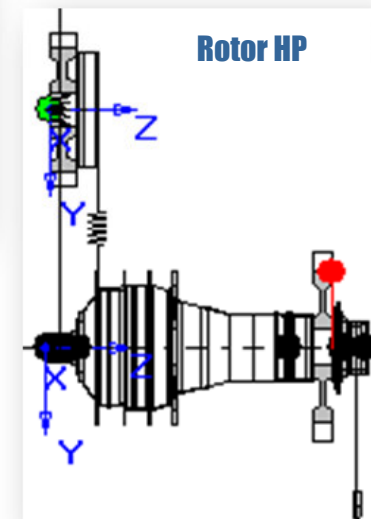
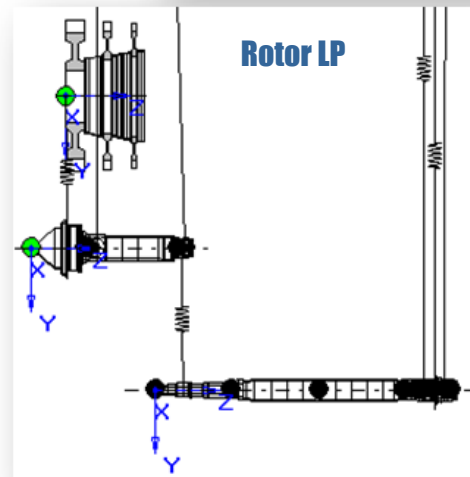
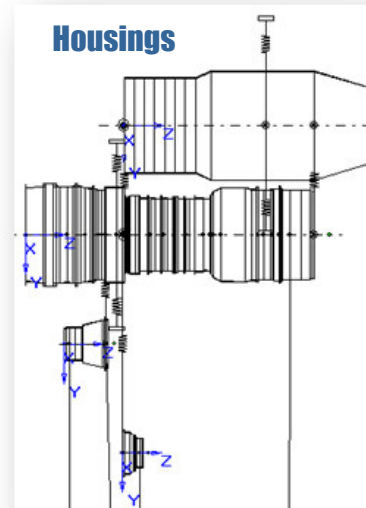
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Model levels and sub-models

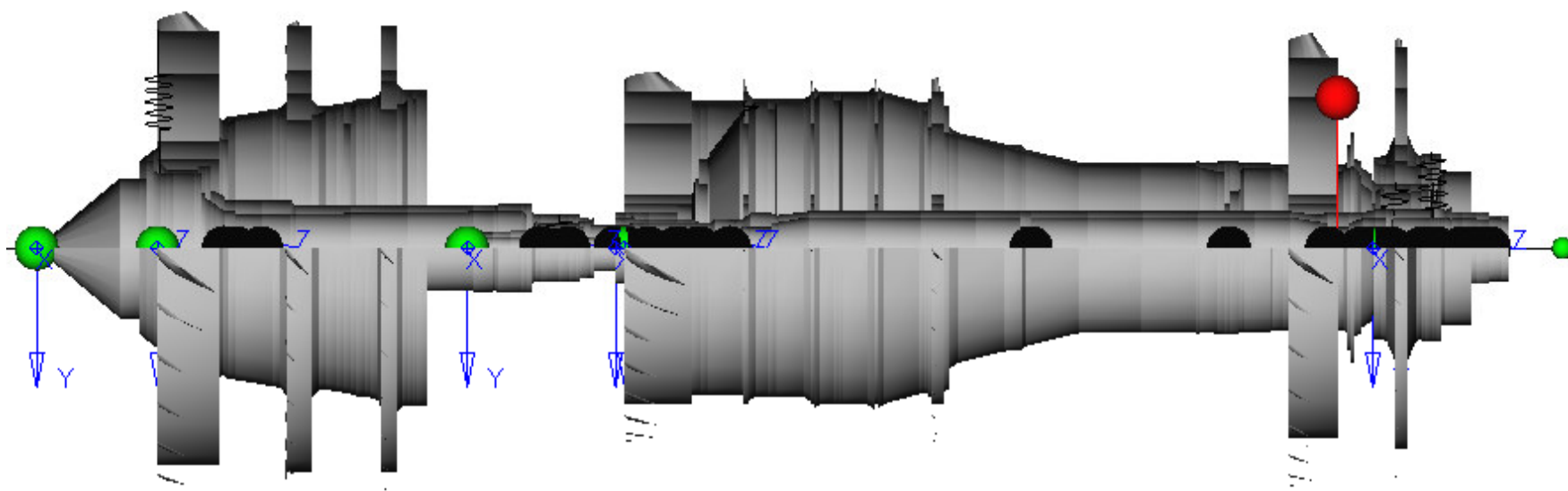
A dynamic model may be multi-level and consist of the following structure items:

- Subsystems – low level structure item constructed out of standard elements
- Assembly – may consist of any structure items
- Sub-models – structure parts stored in an outer file not inside the project

Structure items are assembled with different types of links (bearings)



Twin-shaft HP and LP rotors 3D- model



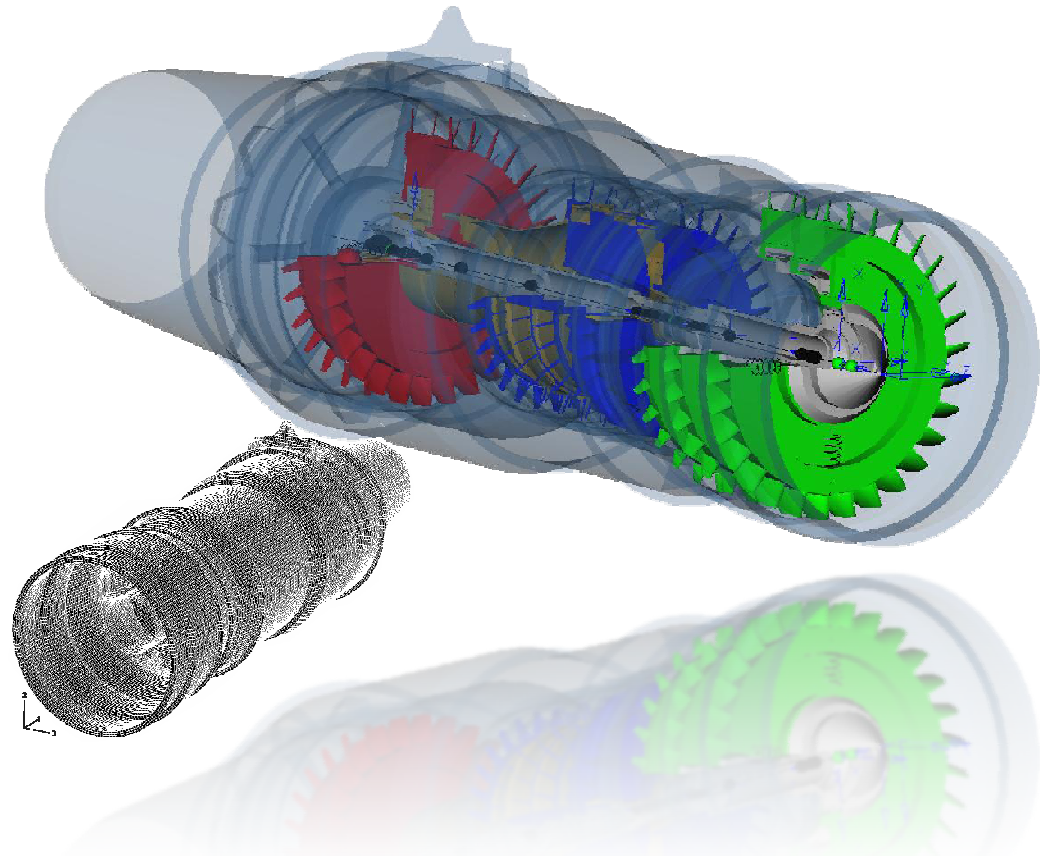
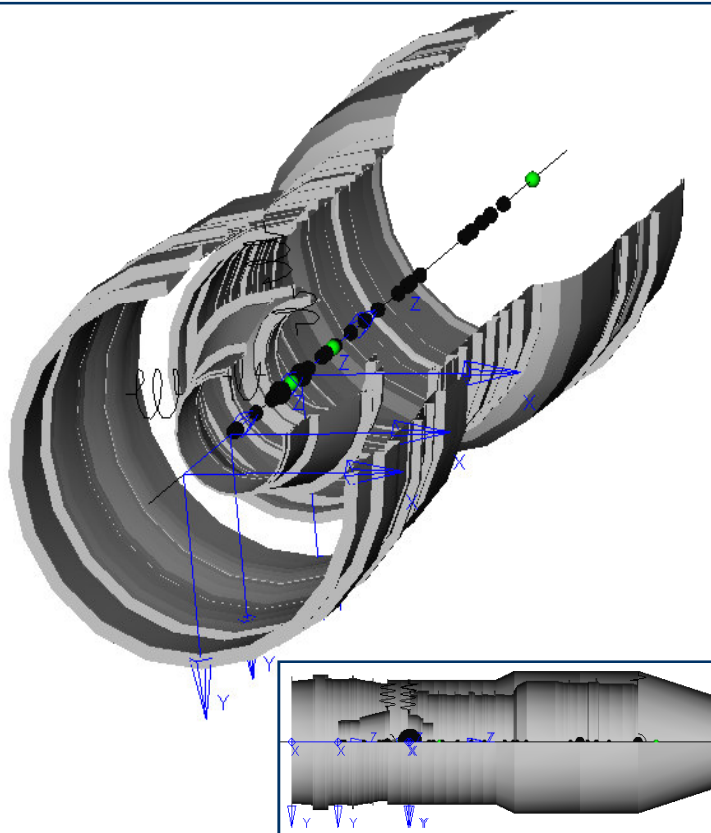
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Housing models



Modeling elements – shells and rigid links



Dynamics R4 also lets importing of housings FEM from ABAQUS, NASTRAN, ANSYS

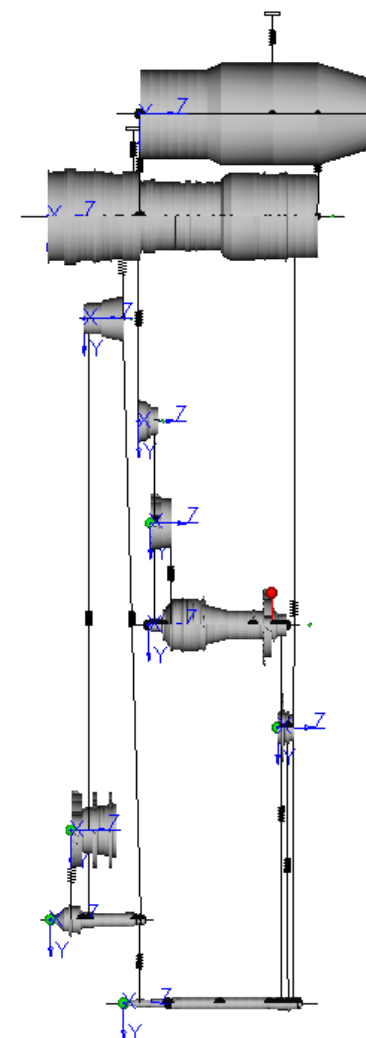
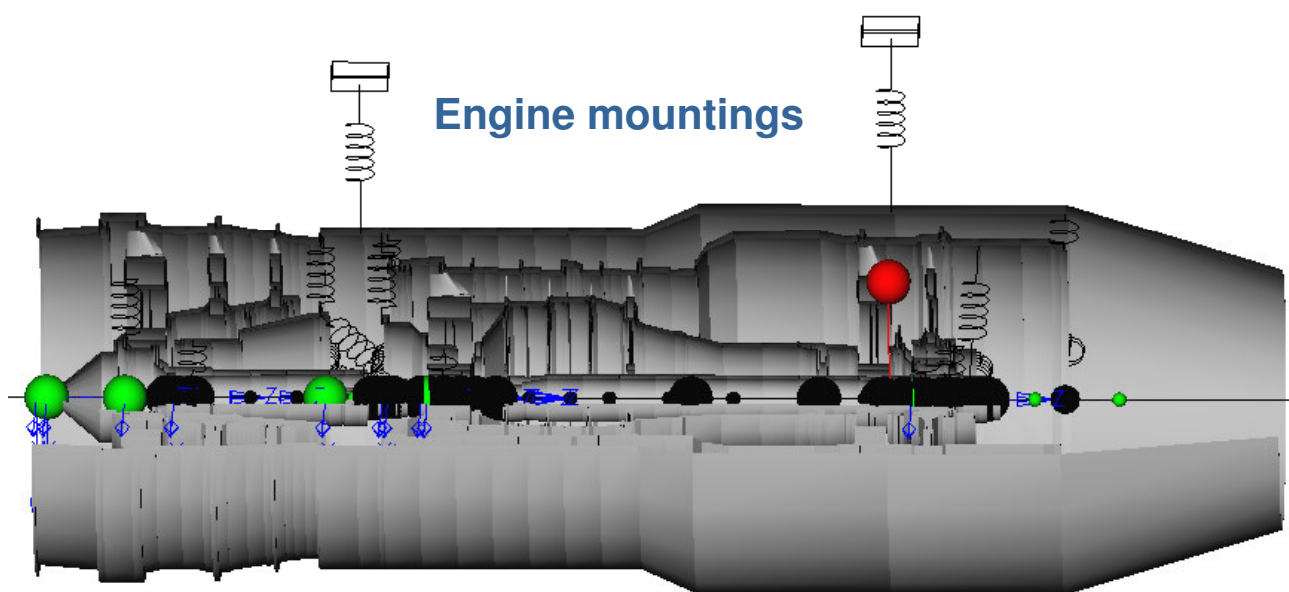
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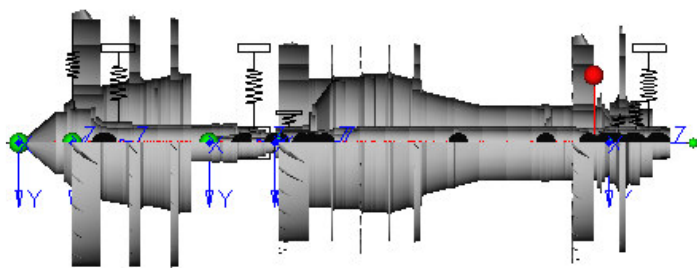
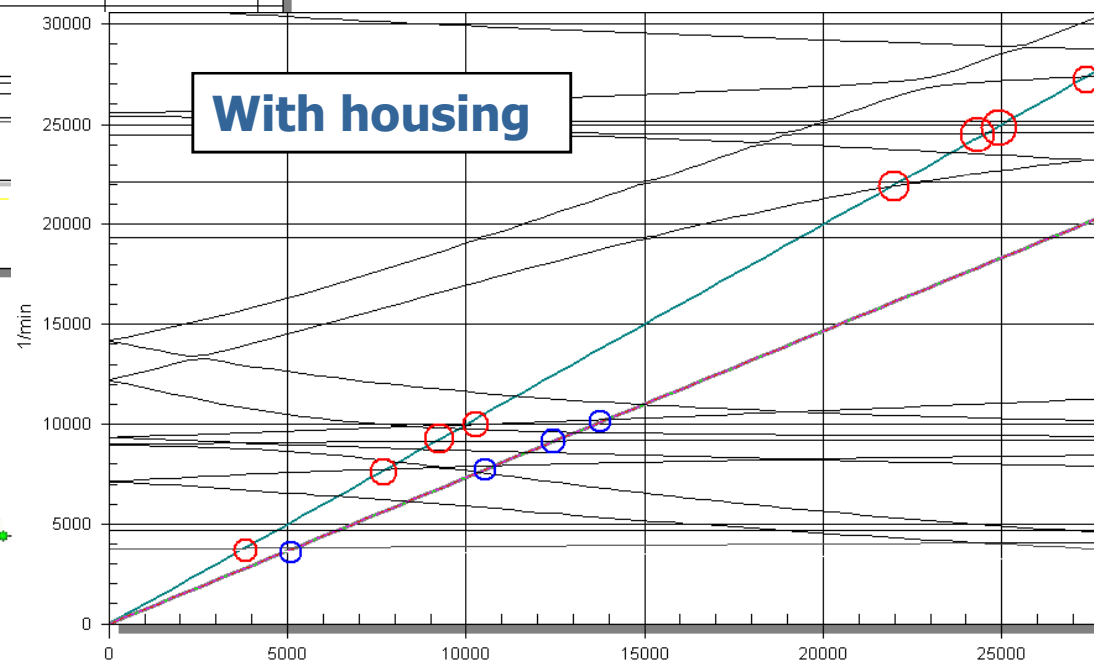
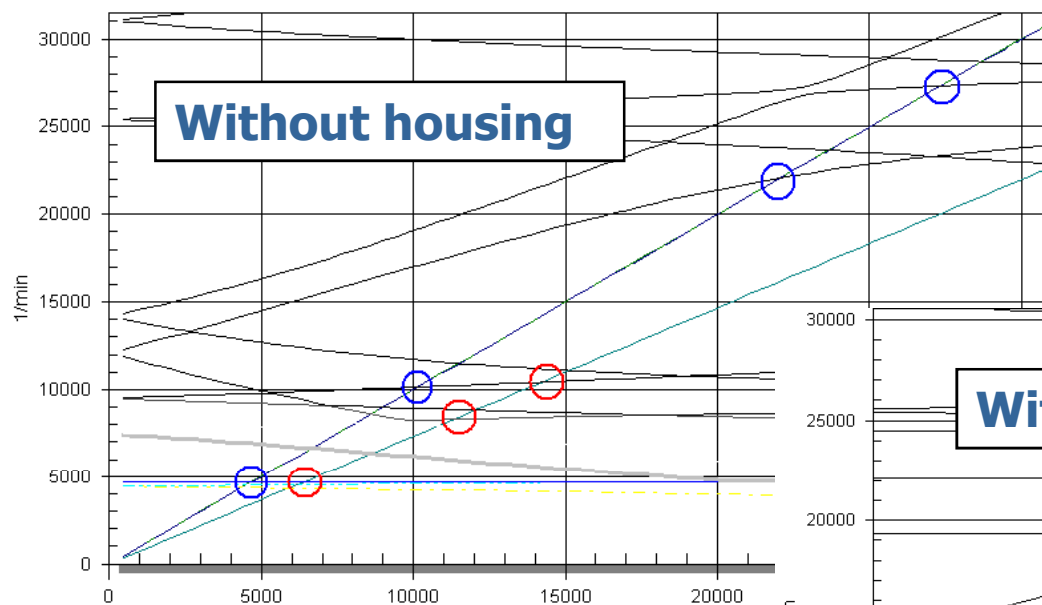
Gas-turbine engine 3D- model



2 variants of co-axial subsystems visualization



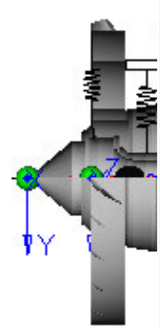
Natural frequency maps



Critical speeds

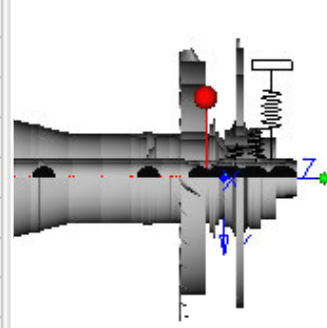
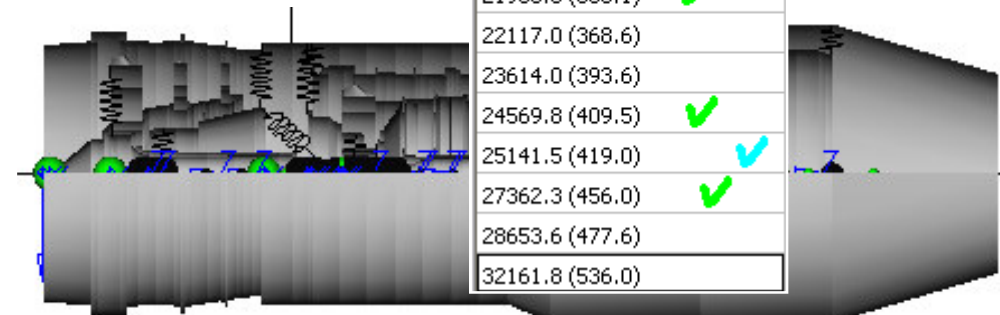


Without housing



4355.5 (72.6)	
4505.4 (75.1)	✓
4702.8 (78.4)	
6641.9 (110.7)	
8118.8 (135.3)	✓
8622.7 (143.7)	
8994.3 (149.9)	
10144.5 (169.1)	✓
11498.5 (191.6)	
22061.5 (367.7)	✓
23645.6 (394.1)	
27316.4 (455.3)	✓
28709.7 (478.5)	
32181.4 (536.4)	
32651.7 (544.2)	
32964.3 (549.4)	

With housing

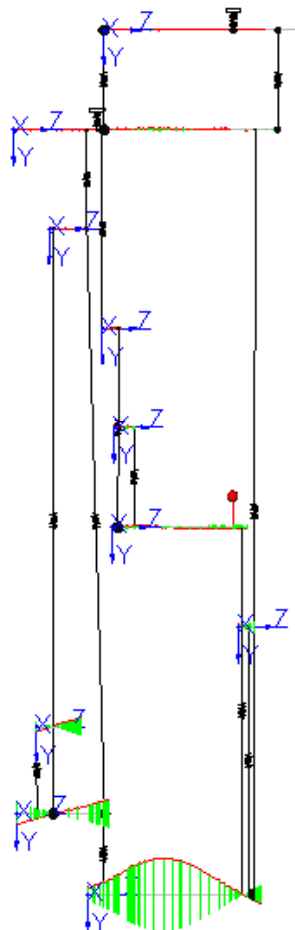



3672.4 (61.2)	
3786.9 (63.1)	✓
4702.8 (78.4)	
6375.6 (106.3)	
7751.4 (129.2)	✓
8098.1 (135.0)	
8748.2 (145.8)	
9137.5 (152.3)	✓
9768.5 (162.8)	
9973.0 (166.2)	✓
11413.5 (190.2)	
19314.4 (321.9)	
21905.8 (365.1)	✓
22117.0 (368.6)	
23614.0 (393.6)	
24569.8 (409.5)	✓
25141.5 (419.0)	✓
27362.3 (456.0)	✓
28653.6 (477.6)	
32161.8 (536.0)	

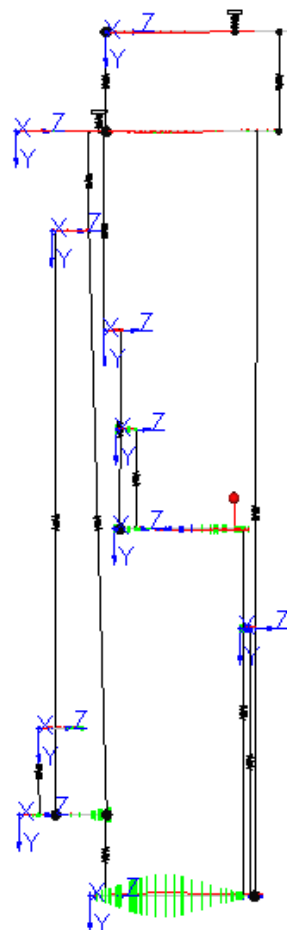
Mode shapes



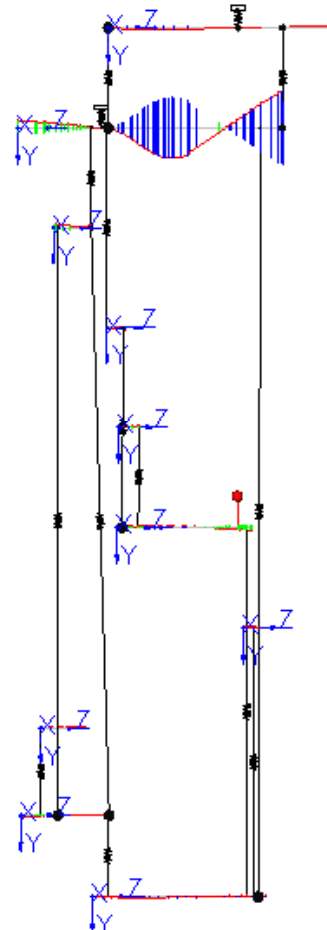
21905 1/min



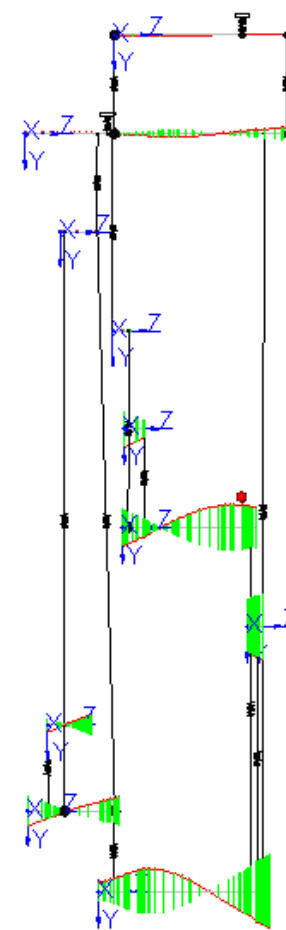
24569 1/min



25141 1/min



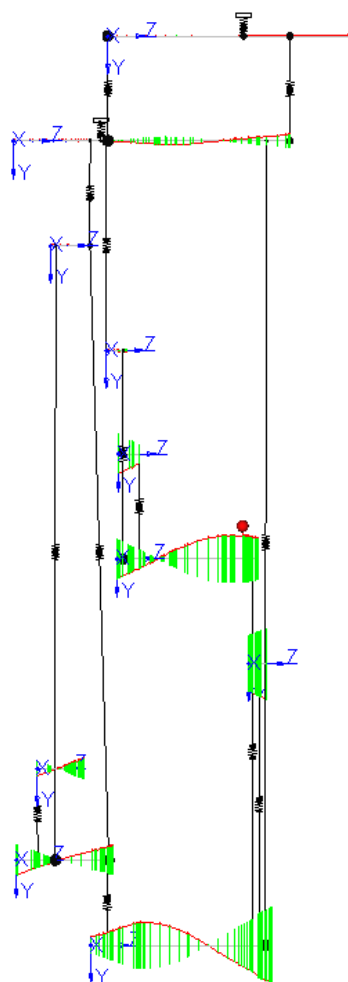
27362 1/min



Mode shape (Forward precession)



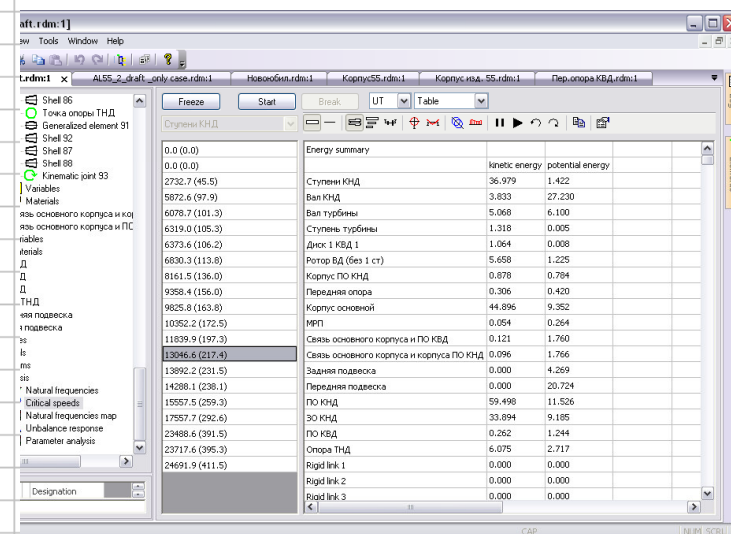
27362 1/min



0.0 (0.0)
0.0 (0.0)
0.0 (0.0)
0.0 (0.0)
3672.4 (61.2)
3786.9 (63.1)
4702.8 (78.4)
6375.6 (106.3)
7751.4 (129.2)
8098.1 (135.0)
8748.2 (145.8)
9137.5 (152.3)
9768.5 (162.8)
9973.0 (166.2)
11413.5 (190.2)
19314.4 (321.9)
21905.8 (365.1)
22117.0 (368.6)
23614.0 (393.6)
24569.8 (409.5)
25141.5 (419.0)
27362.3 (456.0)
28653.6 (477.6)
32161.8 (536.0)
32651.7 (544.2)
32964.3 (549.4)
33326.8 (555.4)
33385.0 (556.4)
37065.1 (617.8)
37312.2 (621.9)

Energy summary		
	kinetic energy	potential energy
Корпус 2-го контура	0.004	0.027
Корпус основной 2	2.157	1.487
Корпус ПО КНД	0.000	0.000
Передняя опора	0.001	0.076
VD_buster	3.765	0.083
VD	41.371	10.775
TND	41.534	0.565
ND_buster	0.323	0.007
ND_pered	0.547	0.215
ND_zad	10.297	5.783
Link 1	0.000	0.117
Задняя подвеска	0.000	0.000
Передняя подвеска	0.000	0.018
МПП	38.223	72.313
Опора ТНД	50.323	4.743
ПО КНД	0.033	0.005
ПО КВД	8.545	1.612
ЗО КНД	2.876	2.174
Rigid link 2	0.000	0.000
Rigid link 1	0.000	0.000
Stiff link_1	0.000	0.000
Stiff link_1	0.000	0.000
1	0.000	0.000
Stiff link_1	0.000	0.000
Total bodies	100.000	19.017
Total links	100.000	80.983
Total		100.000

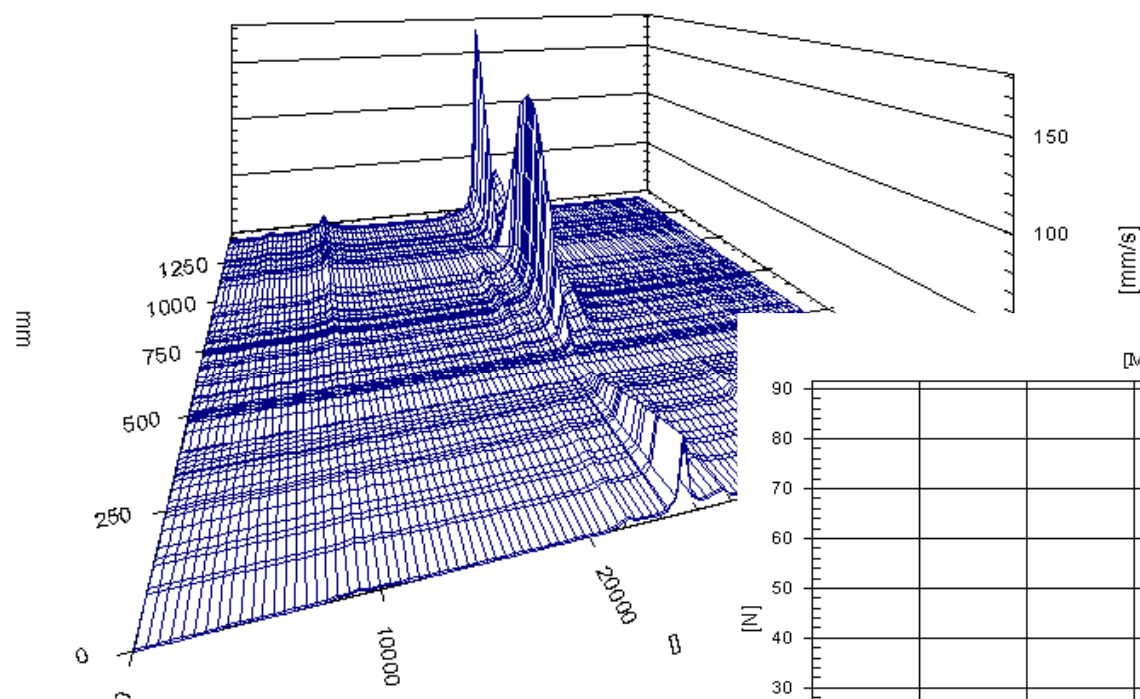
Text output of energy distribution in twin-shaft GTE model



Unbalance response



Unbalance response (3D-view)



Bearing reactions

Unbalance response

[MPIT].[1232.92 Internal].[5.12.2007 (20:39)]

