



CONTRAROTATING SHAFTS

DYNAMICS R4

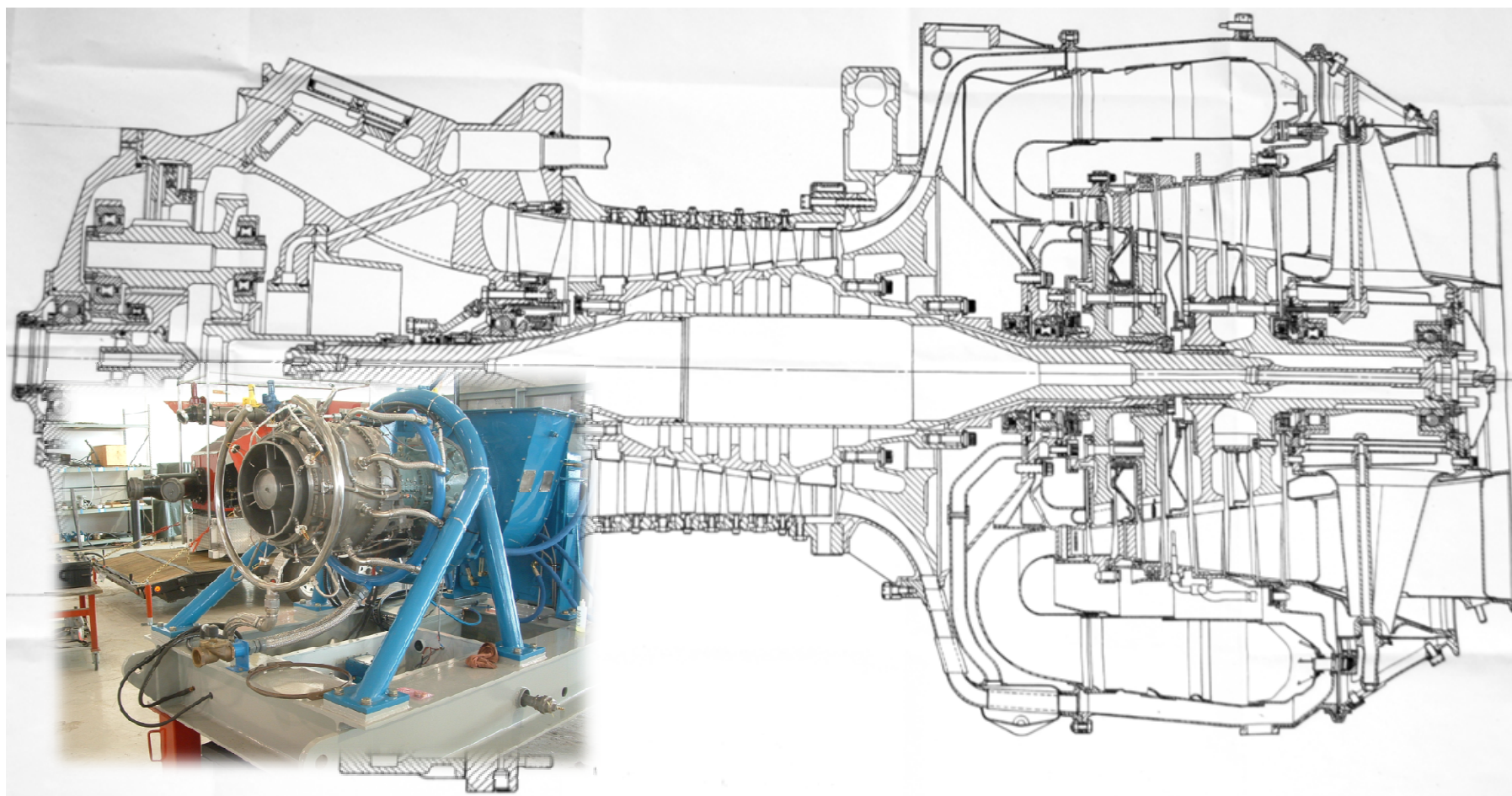
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Backgrounds of the contrarotation

- 1. Opposite signs of the gyroscopic torques*
- 2. A significant change in the critical frequencies spectrum compared with the rotors rotation in one direction*
- 3. A substantial change in the amplitude-frequency characteristics compared with the rotors rotation in one direction*
- 4. Additional resonance modes in the operating range of twin-shaft turbo machine*

T-53 ENGINE has bi-rotating turbine



Nº	GP, rpm	PT, rpm	Power, KW
1	25938	-19106	1052

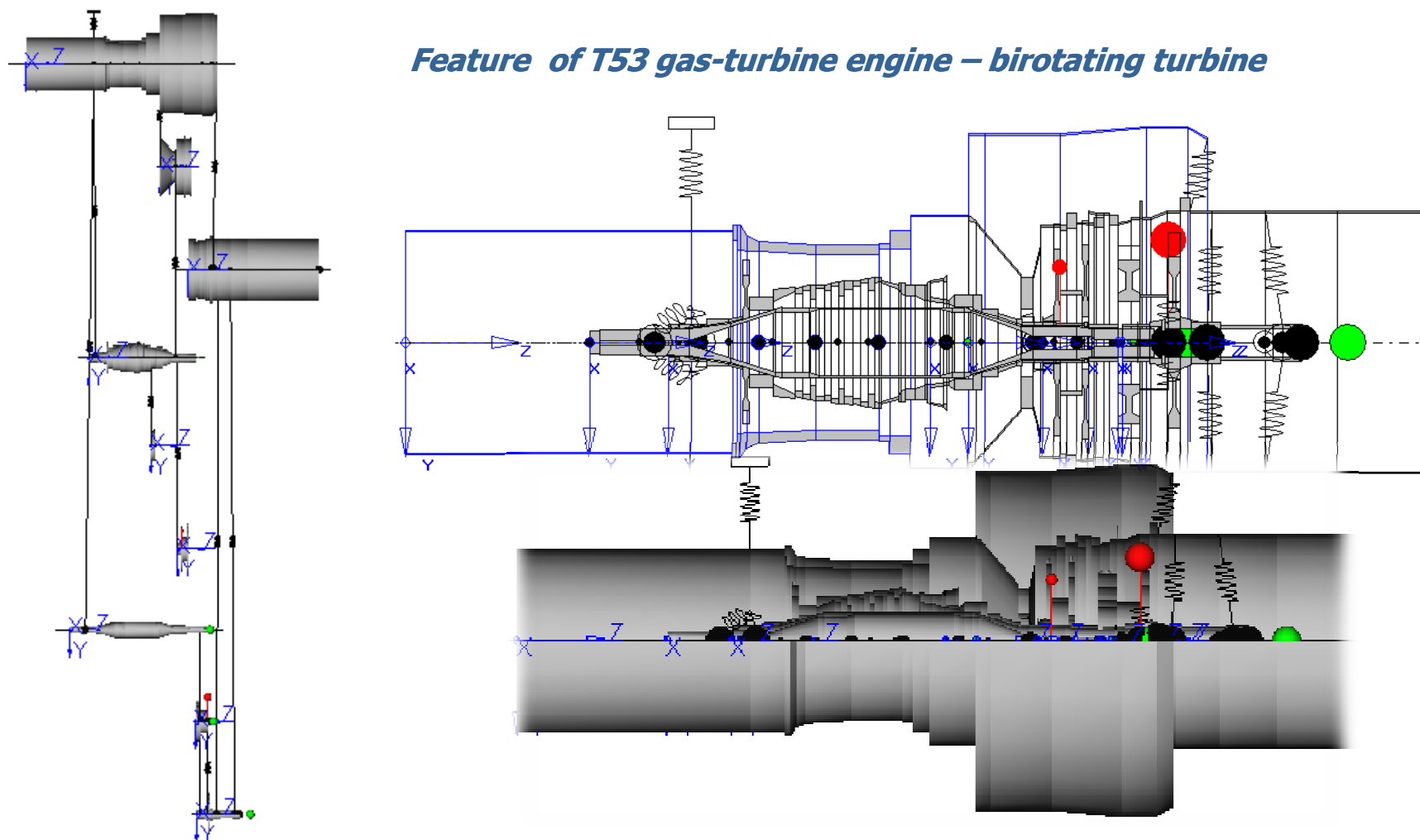
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Full engine multi-level model



Feature of T53 gas-turbine engine – birotating turbine

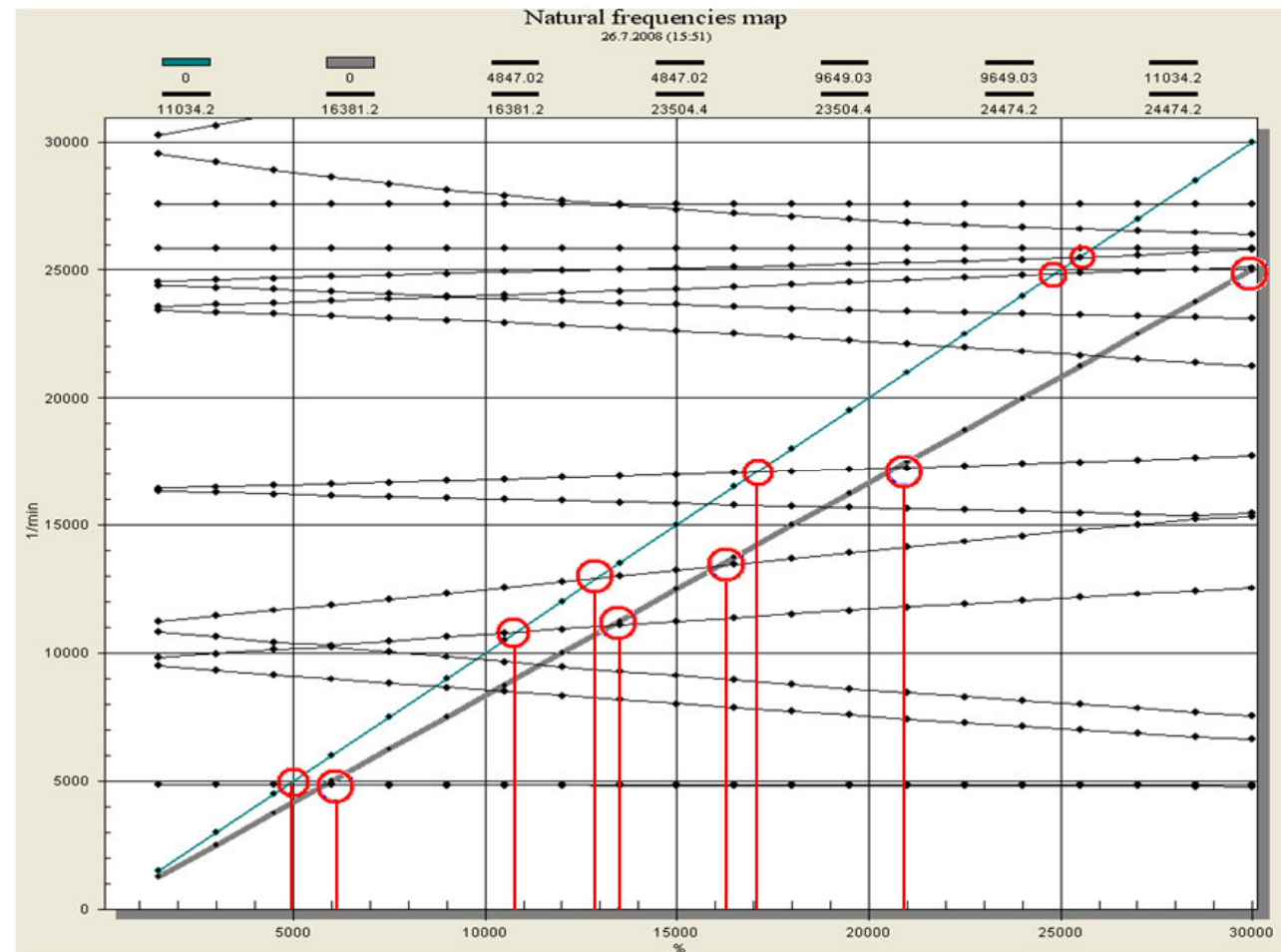


Natural frequencies maps and critical speeds



Same rotation

Critical frequencies of the 1st and 2nd rotor correspond to the direct synchronous precession (the natural frequencies of ascending curves)



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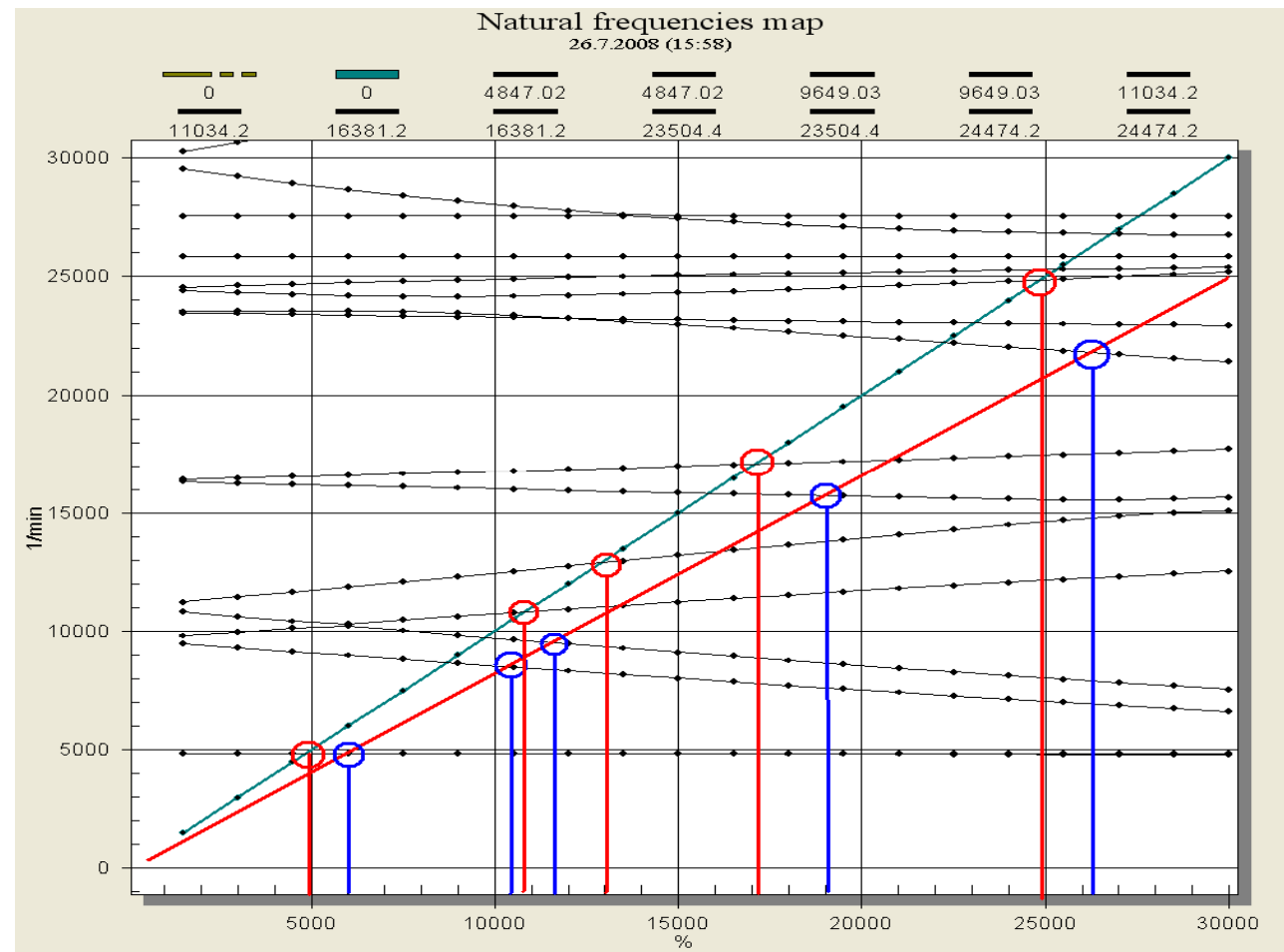
Natural frequencies maps and critical speeds



Contrarotation

Critical frequencies of the 1st rotor correspond to the direct synchronous precession (the natural frequencies of ascending curves)

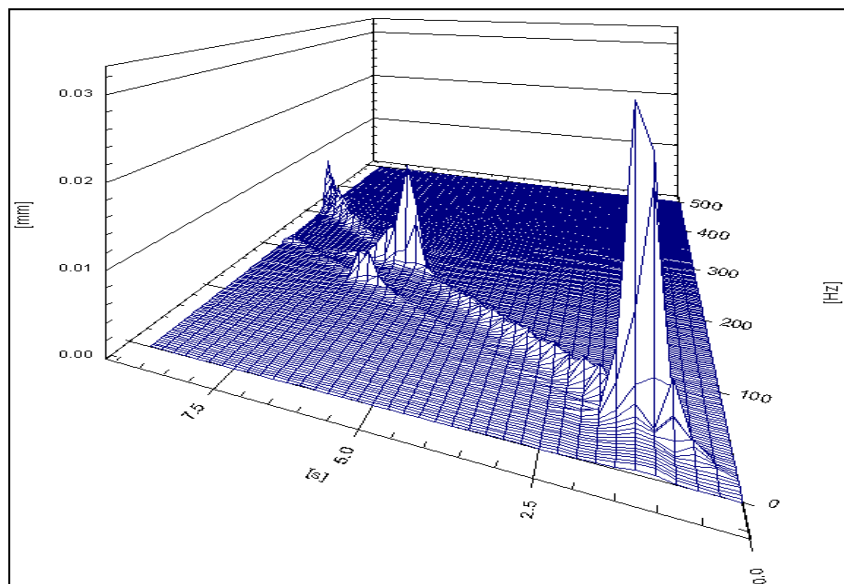
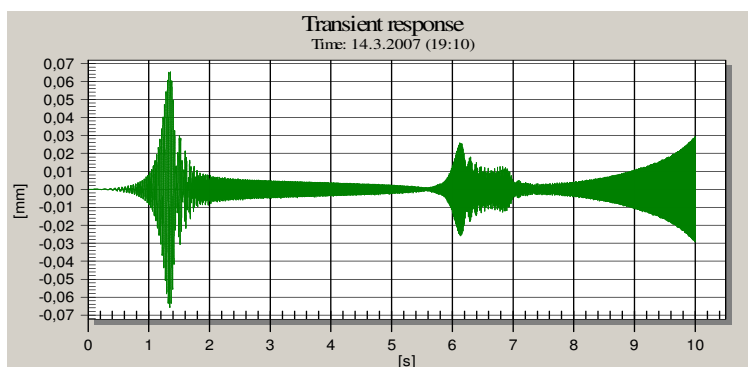
Critical frequencies of the 2nd rotor correspond to the direct synchronous precession (the natural frequencies of descending curves)



Transient solutions



Same rotation



Contrarotation

