

1.8.21. MODELING CHANGE OF TECHNICAL STATE OF MECHANISMS AND MACHINES

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In the estimation of technical state and scientific prognostication of mechanical systems' remaining life, physical and mathematical modeling plays an important role. Modeling can be applied to alteration of the object because of the degradation processes, such as: aging, corrosion, wear and damage accumulation. Modeling permits to improve measurement accuracy and objectivity. It helps to decode inspection sensors' signals during the experimental investigation of machines. But the main advantage of modeling consists in the prognostication of service behavior, emergency situations and remaining life.

Scientific base for research of technical state of train of machines includes modern achievements in mechanics (theory of machines and mechanisms, dynamics, strength, dependability) and in physics, chemistry of degradation processes (aging, corrosion, wear). Dynamic processes, modes of deformation, wear of tribounits, and fatigue damage accumulation in machines are closely coupled and influence each other. Therefore the estimation of technical state based on one criterion leads to mistake as a rule.

Suggested report is about multicriterion modeling of technical state of machinery.

Analyzed problems:

- methodological approach in design of diagnosis model of technical state of machines;
- mathematical formulation of deformation of mating parts in wear process;
- dynamics of mechanisms, taking into consideration changes of clearance gap in tribounits;
- reverse influence of dynamics on wear process;
- fatigue damage accumulation in machine elements and its interaction with wear and dynamics of machines.

This interaction helps to improve effectiveness of limited number of methods of experimental estimate of technical state of machines without their stopping and dismantlement. These methods are: vibration monitoring, diagnostics of machine oil based on wear products, etc.

Mathematical model is based on conception that technical state of machine is generalized vector, and change of state is its motion in multivariate space. Calculus of approximations is applied in solving of these problems. Solution algorithm is given in the report.

Diagnosis of compressor equipment is an example that shows the capacity of using these methods in examination of equipment in unsafe environment.

This methodology is examined in the book "Diagnostic models of change of technical state of mechanical systems" / Under the editorship of V.V.Grib/; part 1, 2007 – 300 p; part 2, 2008 – 263 p – Moscow: The Moscow Automobile And Road Construction Institute (State Technical University) MADI (STU).