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Ryspek Usubamatov

Kyrgyz State Technical University, Kyrgyzstan

Fundamental principles of gyroscope theory

Gyroscope devices are primary units for navigation and control systems in aviation, space, ships, and other industries. The main property of the gyroscope device is maintaining the axis of a spinning rotor for which mathematical models have been formulated on the law of kinetic energy conservation and the changes in the angular momentum. However, known mathematical models for the gyroscope effects do not match actual forces and motions underway. The nature of the gyroscope properties is more complex than represented by contemporary theories. Recent investigations have demonstrated that gyroscopes have four inertial forces interdependently and simultaneously acting on them. These forces are internal kinetic energies generated by the mass-elements and centre-mass of the spinning rotor and represented by centrifugal, Coriolis, and common inertial forces as well as changes in angular momentum. The applied torque generates internal resistance torques that based on action of centrifugal and Coriolis forces; and the precession torques generated by common inertial forces and by the change in the angular momentum. Apart from these, the friction forces acting on the gyroscope supports play considerable role in decreasing the internal kinetic energy of the spinning rotor. The new mathematical models for gyroscope effects describe clearly and exactly all known and new gyroscope properties. Mathematical models for the most unsolvable motions of the gyroscope with one side support are validated by practical tests. Formulated models for motions of the gyroscope represent fundamental principles of gyroscope theory based on the actions of internal centrifugal, Coriolis and inertial forces and the change in angular momentum, and external applied and friction forces. This new theoretical approach for the gyroscope problems represents new challenge in engineering science.

Figure 1: Stand of gyroscope with one side fixed support

Biography

Ryspek Usubamatov completed his Graduation, PhD at Bauman Moscow State Technical University and Doctor of Technical Sciences at Academy of Sciences of Kyrgyzstan. He worked as an Engineer-Designer of machine tools at engineering company. He is a Professor at Kyrgyz State Technical University and worked at universities in Malaysia. He has published more than 300 papers in reputed journals, more than 60 patents of inventions in engineering and seven books in area of Manufacturing Engineering. He supervised six PhD and several dozens of MSc students. His research interests include "Gyroscope theory and productivity theory for industrial engineering".

ryspek0701@yahoo.com