Identification of solid state wave gyroscope parameters at slowly varying forced oscillation frequency

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Currently, the solid state wave gyroscope (SSWG) is one of the prospective transducers of the inertial data, as it shows high reliability and has small overall dimensions at relatively low cost. The navigation and traffic control systems for the objects of various applications designed on the base of SSWG have a wide range of usage. To increase the SSWG characteristics of precision is an up-to-date line of research. The problem of identifying the SSWG parameters is connected with increasing the SSWG precision and aimed at estimating the tolerance caused by both the resonator manufacturing imperfections and nonlinear nature of the oscillations. There is a technique which allows defining the nonlinearity factor along with the linear model parameters. It uses a time-consuming measure procedure which is carried out at stationary modes of constrained oscillations corresponding to various adjustable frequencies of the generator. The conduct of such measurements requires numerous frequency manipulations and waiting for the transition processes ending. This work suggests a technique for identifying the gyroscope parameters with consideration for nonlinearity at slowly varying frequency of the constrained oscillations. The identified parameters include the frequency difference, the versatility, the parameters of the external action onto the resonator and the nonlinearity factor. These parameters are needed for the quality control and technological advancement of gyroscope manufacturing as well as for its drift cancellation. The allowance for the nonlinear nature of the resonator oscillations enables testing at high oscillations amplitudes when the signal-to-noise ratio is fairly high, which helps to increase the accuracy of the parameters identification. In order to estimate the parameters of the obtained mathematical model for the resonator oscillations at slowly varying frequency of the constrained oscillations we use a Kalman optimum filtering algorithm. The developed technique will allow automating the parameters identification process at slowly varying frequency of the constrained oscillations and reducing the time for defining the parameters of the working gyroscope.

Keywords: *solid state wave gyroscope, nonlinear oscillations, parameters identification, Kalman filter*

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