

WAVELET-BASED CONFIRMATORY FACTOR ANALYSIS OF MONITORING DATA FOR REVEALING LATENT FACTOR INFLUENCES ON EVOLUTION OF A SYSTEM

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ABSTRACT– A new technology for monitoring of factors responsible for evolution of technical and other systems is under consideration. It combines capabilities of wavelet transforms and trained factor structures. According to the proposed approach, the samples of coefficients resulted from discrete wavelet transform of initial parameter time series under study and responsible for different observation periods are considered as values of observed variables in the subsequent confirmatory factor analysis to reveal time history of factor influences and estimates of factor interaction. Identification of free factor model parameters (factor variances and covariances) is carried out by a direct (noniterative) procedure based on the maximum likelihood method, which is an alternative to traditional local iterative solution of optimization problems. A statistical method to check significance of factor model components is also discussed. Presented are advantages of the given approach over the traditional simplex method, a set of approaches to development of factor models represented by path diagrams as well as their comparison and software implementation on the base of a graphical programming environment. In addition, a new statistical criterion to estimate applied models' goodness-of-fit measure which is based on Kohonen's self-organizing maps and doesn't require multivariate normality testing of parameters under study is given in details.

KEYWORDS: System condition monitoring, longitudinal data, repeated

measures, confirmatory factor analysis, factor model's goodness-of-fit, discrete wavelet transform.