Floating Vessels Control - Mathematical Modeling of the Waves

Sadko Mandžuka

Brodarski Institute, Zagreb, Croatia

ABSTRACT: The characteristics of sea disturbances (wind, waves, and sea currents) have to be defined quantitatively for the purpose of floating vessels control systems design (auto-pilot, path-control, roll stabiliza-tion, dynamic positioni¬ng, etc.). The convenient approach for the description of wind-generated waves is in the form of the energy spectral density functi¬ons (Pierson-Moskowitz, JONSWAP, Voznesensky-Netsvetaeva, Dar¬byshire, Tabain, etc.). Following a linear theory, using the spectral factorization techniques, the sea spectrum has been modeled by transfer function representation (color filter). An algorithm of non-linear regression for rationalization of sea spectrum is given in the paper. Some new results are presented in the paper.

References:

[1] Morgan, M., 1978, Dynamic Positioning of Off-shore Vessels, Division of The Petroleum Publishing Company, Tulsa, Oklahoma, USA.

[2] Papoulis, A., Probability, Random variables and Stochastic Processes, McGraw Hill, NewYork, 1965, 342-350.

[3] Grimble, M.J., Patton, R.J., Wise, D.A., Use of Kalman filtering techniques in dynamic ship-positioning systems, IEE Proceedings, Vol. 127., No. 1, 1980, 93-102.

[4] Bishop, R.E.D., Price, W.G., 1974, Probabilistic theory of ship dynamics, Chapman & Hall, London.

[5] Lloyd, A.R.J.M., SEAKEEPING: Ship Behav-iour in Rough Weather, JW&S, Chichester, 1989, 106-112.

[6] Mandžuka, S., Some characteristics of sea spec-trum modelling by coloured filter, 833-841, Proceed-ings of International Symposium: Waves - Physical and Numerical Modelling, Vancouver, 1994.

[7] Li, C.K., Leigh, J.R., 1983, S-domain realisation of sea spectrum, Electronics letters, Vol. 19, No. 5, 186-187.

[8] Van Amerongen, J., 1984, Estimating the wave spectrum and the roll angle and its derivatives with an extended Kalman filter, Proc. 7th Ship Control System Symp., Vol. 4, 73-85, Bath.

[9] Демиденко, Е.З.,Оптимизация и регрессия, Наука, Москва, 1989, 216-232.

[10] Fletcher, R., 1987, Practical methods of opti-misation, John Wiley and Sons, Chichester.