

TRANSITIONS BETWEEN DIFFERENT RINGING SCHEMES OF THE CHURCH BELL

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Abstract. We present a hybrid model of church bell. The dynamical system of yoke-bell-clapper is nonlinear and discontinuous. We use the Lagrange equations of the second type to derive formulas that describe the system's motion. The energy between the bell and the clapper is transmitted via impacts, here modeled using a coefficient of energy restitution. The values of the system's parameters have been determined basing on the measurements of the biggest bell "The Heart of Lodz" in the Cathedral Basilica of St Stanislaus Kostka, Lodz, Poland. Using the same bell we also validate the model by comparing the results of numerical simulations with experimental data. The presented results show that the described model is a reliable predictive tool which can be used both to simulate the behavior of the existing yoke-bell-clapper systems as well as to design the yokes and predict the motion of new bells.