

This work is based on the experiment that was carried out by R. J. Donnelly and A. C. Hollis Hallett in 1958. Measurements were carried out with a torsionally oscillating disc in superfluid helium over a temperature range of 1.37 to 2.16 K at saturated vapor pressure. We were able to measure time dependences of the angular velocity of the disc and to determine critical values of the angular velocity amplitude. The obtained temperature dependences also show that the measured nonlinear forces originate from the superfluid component. Based on these measurements, a model describing the mechanisms of the transition to turbulence in a flow due to a torsionally oscillating disc is proposed.