

N^{th} -order superintegrable systems separating in polar coordinates

İsmet Yurduşen

Department of Mathematics, Hacettepe University, 06800 Beytepe, Ankara, Turkey

Classical and Quantum mechanical superintegrable systems that are separating in polar coordinates are analyzed. The motion is restricted to a Euclidean plane E_2 and the additional integral is assumed to be a polynomial of degree $N \geq 3$ in momenta. Cases $N = 3, 4$ and 5 are investigated in detail. This leads to a general and unified description of higher-order superintegrability in the case of potentials allowing separation in polar coordinates. For the exotic potentials, the existence of an infinite family of superintegrable potentials in terms of the sixth Painlevé transcendent P_6 is conjectured and will be demonstrated for the first few cases.