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Use of advanced mechanics problems for undergraduate research projects

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Mechanics problems (including advanced problems in rigid body dynamics) provide a basis for research projects which are attractive to high-achieving undergraduate students. These projects require students to draw on their knowledge from multiple areas, including mathematics, programming, and physics, and also require visualisation of the complex motion of extended objects. This integrated approach provides an authentic research experience. It deepens students' conceptual understanding and encourages a more reflective mindset when tackling unfamiliar problems, supporting the development of expert-like thinking in undergraduate science education. Here we describe student research projects including the dynamics of a tossed mobile phone, the motion of rolling biased balls (balls with an offset centre of mass) and the motion of rolling magnetised balls (which interact with the Earth's magnetic field). Each of these projects has been undertaken by undergraduate students in the physics major at the University of Sydney, and it has led to refereed publications, including for first-year students.

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