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Zermelo's navigation problem in the calculus of variations

Ernst Zermelo's first researches in mathematics were in the calculus of variations. His 1894 doctoral dissertation at the University of Berlin extended some of Weierstrass's methods in the theory of sufficiency. In the years which followed Zermelo's interests shifted to set theory, and his contributions to this subject would prove to be of fundamental importance. In 1931 Zermelo returned to the calculus of variations and published two papers on what is known as the navigation problem. A ship or airplane must travel under power from A to B in the face of currents or winds. The problem is to determine the trajectory that will produce the least time of transit. Zermelo's solution was based on a very special application of the techniques of the calculus of variations, in which he derived a result known as Zermelo's navigation formula. The paper will examine Zermelo's solution to the navigation problem and its reception and further development by researchers of the 1930s.