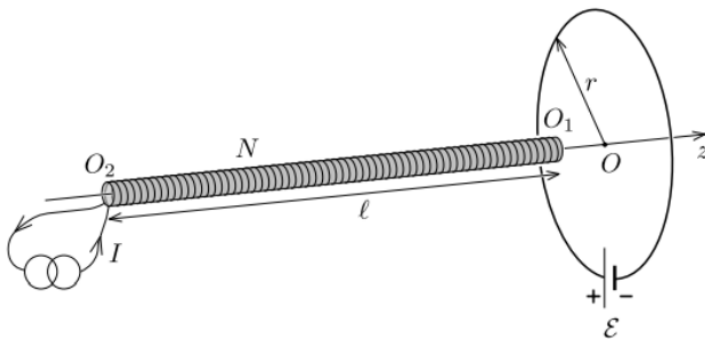


Solenoid and loop

A closed circular loop of radius r consists of an ideal battery of electromotive force ξ and a wire of resistance R . A long thin air-core solenoid is aligned with the axis of the loop (z -axis). Its length is $l \gg r$, cross-sectional area is A ($r \gg \sqrt{A}$), and the number of turns is N . The solenoid is powered by a constant current I provided by an ideal current source. The directions of the currents in the solenoid and in the loop are the same (clockwise in the figure).



a) Find the force F_1 acting on the solenoid when its head O_1 is positioned in the loop centre O . What is the force F_2 acting on the solenoid when its tail O_2 is located in the centre of the loop?

b) Suppose now, that the solenoid is moving slowly with a constant velocity v along z -axis starting far away from the loop, going past its centre, and proceeding further to the right in positive z -direction. Plot the current J flowing in the loop as a function of time. Highlight important features and values on the graph. The velocity v is so small that self inductance of the loop can be neglected.