Current Produced by Motional EMF

- Motional EMF: $\mathcal{E} = vBL$
- Terminal voltage: $V_{ab} = \mathcal{E} - Ir$
- Electric current: $\mathcal{E} - Ir - IR = 0 \Rightarrow I = \dfrac{\mathcal{E}}{r+R}$
- Applied mechanical force: $\vec{F}_{app}$
- Magnetic force: $\vec{F}_B = I\vec{L} \times \vec{B}$
- Motion at constant velocity: $\vec{F}_{app} = -\vec{F}_B$
- Electrical power generated: $P_{gen} = \mathcal{E}I$
- Mechanical power input: $P_{in} = Fv = (ILB)v = (vBL)I = \mathcal{E}I$
- Electrical power output: $P_{out} = V_{ab}I = \mathcal{E}I - I^2r$