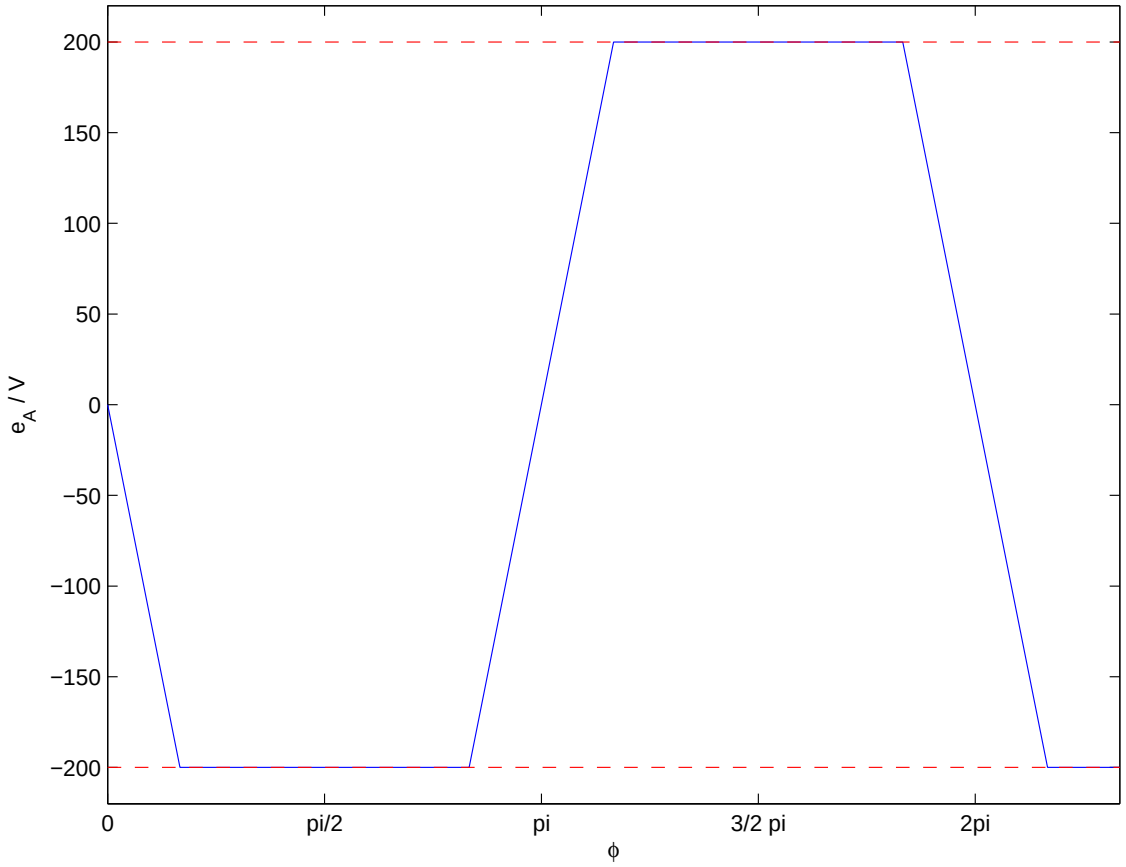
Exercise 13: Commutation of a BLDC Motor

Consider a 3 phase symmetrical BLDC motor with distributed windings. The inductance of the stator winding in all the 3 phases is $L_S = 20\,\text{mH}$ (including the mutual inductance). The available DC link voltage is $U_{DC} = 570\,\text{V}$. The motor speed is $n = 3000\,\text{min}^{-1}$. At this speed the motor delivers a torque of $T = 10\,\text{Nm}$.

The induced EMF for a phase is shown below.



a) Sketch the currents in all three phases.

b) Caluculate the commutation time. A phase advance has to be chosen such that the influence of induced voltage is compensated. How big is the phase advance?

c) In contrast to (b) the phase advance should be calculated in such a way, so that the commutation is complete when the line-to-line voltage crosses zero. What is the commutation time then?