$$\vec{a}(t) = (\ddot{\rho} - \rho \, \dot{\phi}^2) \, \vec{e}_{\rho} + (\rho \, \ddot{\phi} + 2 \, \dot{\rho} \, \dot{\phi}) \, \vec{e}_{\phi} + \ddot{z} \, \vec{e}_z$$