FACTORS AFFECTING SIZE OF MOTOR – PART 1

Motor output power:

$$P_{out} = \mathrm{K}B_{av}\mathrm{ac}D^2\mathrm{L}N_s$$

where,
P_{out} = Output power (W)
K = Constant
B_{av} = Average airgap flux density (T)
ac = Electrical loading (amp – turn/m)
D = Rotor diameter (m), L= Length of rotor (m)
N_s = Motor speed (rpm)

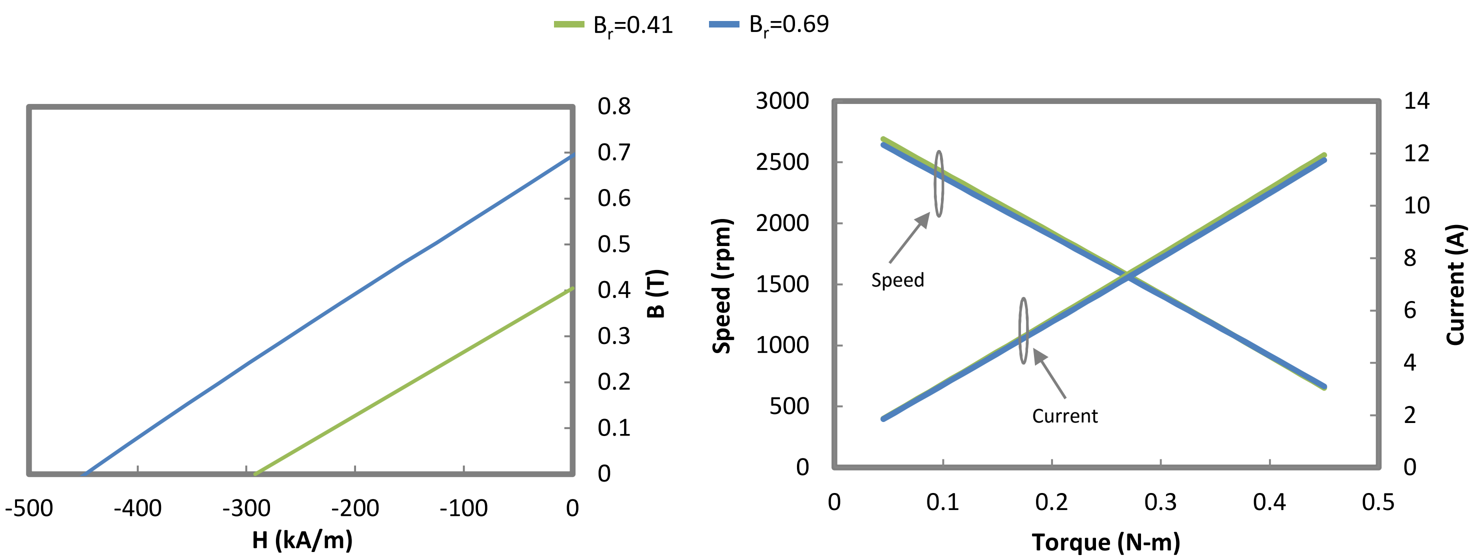
For the same output power, the size of the motor can be reduced by:

1. Increase in magnetics/magnetic loading (i.e. Increase in magnet B_r and hence the B_{av})
2. Increase in motor speed (N_s)
3. Increase in winding current or no. of turns/coil (i.e. Increase in ac)

Increase In Magnetics/Magnetic Loading (B_r)

Reducing the size of the motor by simply reducing the armature/rotor is not viable, as this would limit the space for winding thus hinder *ac* (electrical loading). By increasing B_r of a magnet, however, the magnet size can be reduced, enabling a smaller motor size while maintaining space for *ac*.

B_r (T)	**0.41**	**0.69**
Volume ratio	1.00	0.69
Magnet weight (g)	44.0	29.5
Total motor weight (g)	355	246



Factors to be considered while using magnet with higher B_r:

- Possibility of magnetic saturation in armature/stator teeth, yoke and back iron/housing
- Possibility of increased core loss, as core loss is proportional to the square of flux density
- Higher no-load current

61 Science Park Road #01-19 The Galen
Singapore Science Park II Singapore 117525
research@magnequench.com
www.mqitechnology.com

neo Magnequench