chapter 9_3 Speed control of DC motors via resistance adjustment

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% Onwubolu, G. C.
% Mechatronics: Principles & Applications
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% Mechatronics: Principles & Applications Toolbox Version 1.0
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%
% Chapter 9: Speed control of DC motors via resistance adjustment
%
% Example 9.3  MATLAB's calculating power is greatly enhanced using the
Symbolic
% Math Toolbox. In this example we demonstrate its power by deducing the
% resistance to be added to armature winding, efficiency after addition,
% and resistance to be added for holding condition
%data
%Problem 1
%data
%Vt=150;
%I=10;
%Nrpm=1200;
%Ra=1;
%Rf=150;
%Losses=100;
%Reductiion=50%;

%input data from keyboard
Vt=input('Source voltage (volt): Vt  '); %input from keyboard
I=input('Motor line current: (amps): I  '); %input from keyboard
Nrpm=input('Motor speed (rpm): Nrpm  '); %input from keyboard
Rf=input('Shunt resistance  (ohm): Rf >>Ra '); %input from keyboard
Ra=input('Armature resistance  (ohm): Ra << Rf (much smaller)  '); %input
from keyboard
Losses=input('Rotational losses  (Watt): Losses  '); %input from keyboard
Reduction=input('Reduction in motor speed (% reduction): Reduction  ');
%input from keyboard
%computation commences
Red=(1-Reduction/100);
K=Nrpm/(Nrpm*Red);
'Shunt current'
If=Vt/Rf
'Armature current'
Ia=I-If
'Power input'
Pin=Vt*I
'Resistance to be added to achieve reduction'
Radd=(Vt-(Vt-Ia*Ra)/K)/Ia-Ra
'Losses before adding armature resistance'
Loss1=(If^2)*Rf+(Ia^2)*Ra+Losses
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'Losses after adding armature resistance'
Loss2=(If^2)*Rf+(Ia^2)*(Ra+Radd)+Losses
%Efficiencies
'Efficiency before adding armature resistance'
Eff1=((Pin-Loss1)/Pin)*100
'Efficiency after adding armature resistance'
Eff2=((Pin-Loss2)/Pin)*100
%Resistance to operate at holding condition
R_hold=Vt/Ia-Ra

'Finish'
```