Tesla Model S Induction Motor

RWD 85 Model

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Chapter 1. Introduction

The specs of the induction motor are as follows:

```
% Input Parameters of the
% Tesla Model S Induction Motor
power_max = 270;                    % [kW] from project2
torque_max = 440;                   % [Nm] from project2
speed_max = 225;                    % [km/sa] from project2
p1 = 2;                             % [-] pole pair from Hendershot-FIU-Lecture
power_rated = 288 * 0.746 ;         % [kW] from Hendershot-FIU-Lecture
tire_diameter = 27.7 * 25.4;        % [mm] from
                                    % https://tiresize.com/tires/Tesla/Model-S/
                                    % https://tiresize.com/tiresizes/245-45R19.htm
gear = 9.73;                        % [-] 9.73:1 (transmission) from
                                    % https://en.wikipedia.org/wiki/Tesla_Model_S
speed_rpm_max = (speed_max*10^3/3600)/(tire_diameter*10^-3/2)*(60/2*pi())*gear; %
speed_rpm_rated = 6000;             % [rpm] from Hendershot-FIU-Lecture
                                    % approx. knee of the torque-speed curve
f1 = speed_rpm_rated*2*p1/120;      % [Hz] frequency of the driver unit
```

Chapter 2. Main Dimensions of Stator Core

Dis^2 * L output constant concept is used to determine parameters.

```
% Based on the The Induction Machine Handbook Chpater 14 & 15
neff = 0.96;              % [-] targetted efficiency (IE3)
pwr_factor = 0.88;        % [-] typ. power factor for induction motors
                          % at full load varies between 0.85-0.90
Ke = 0.98 - 0.005*p1;     % [-] Ke defined as E1 / V1n (eq. 14.8)
                          % and approx. given as eq. 14.10
Sgap = Ke * power_rated * 10^3 / (neff * pwr_factor);  % [VA] (eq. 15.2)
stack_aspect = 1.5;       % [-] stack aspect ratio define as
                          % stack length to pole pitch ratio (eq. 14.19)
                          % (table 15.1)
Co = 240*10^3;            % [J/m^3] extracted from figure 14.14
Dis = ((2*p1*p1*Sgap)/(pi()*stack_aspect*f1*Co))^(1/3); %[m] (eq. 15.1)
pole_pitch = pi()*Dis/(2*p1);    % [m] pole pitch (eq. 15.2)
L = stack_aspect * pole_pitch;   % [m] stack length (eq. 15.2)
```