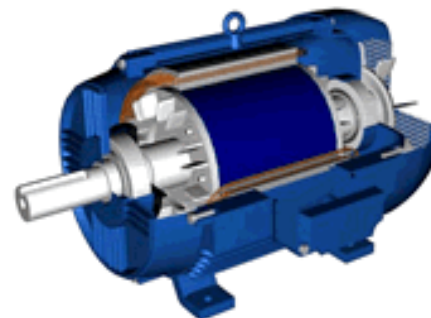
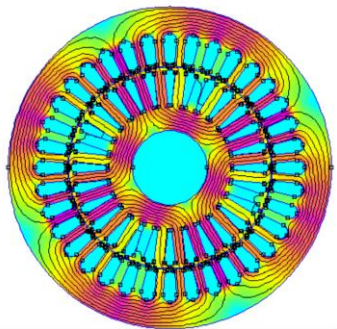
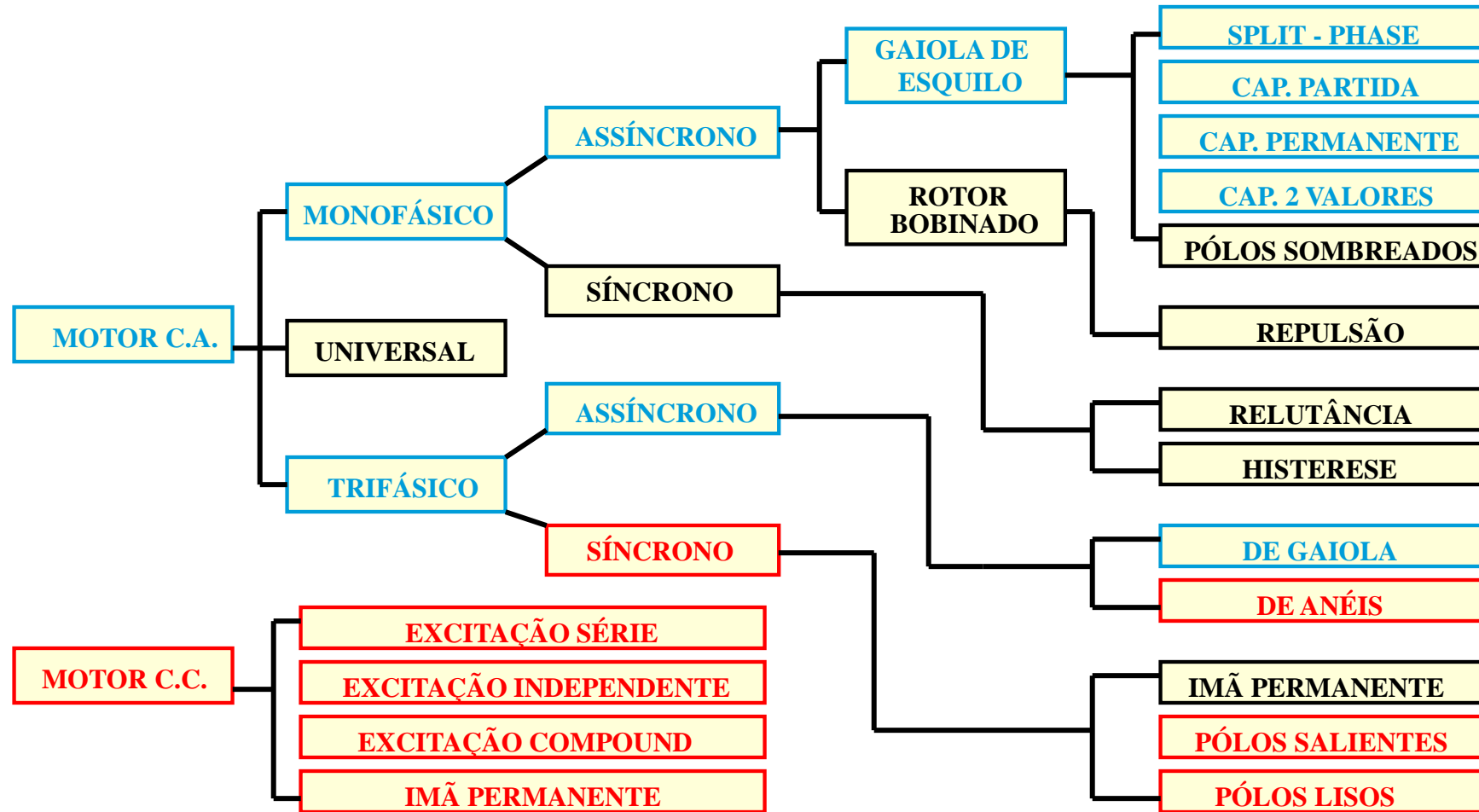


Aspectos construtivos da máquina síncrona


Prof. Allan Fagner Cupertino
afcupertino@ieee.org



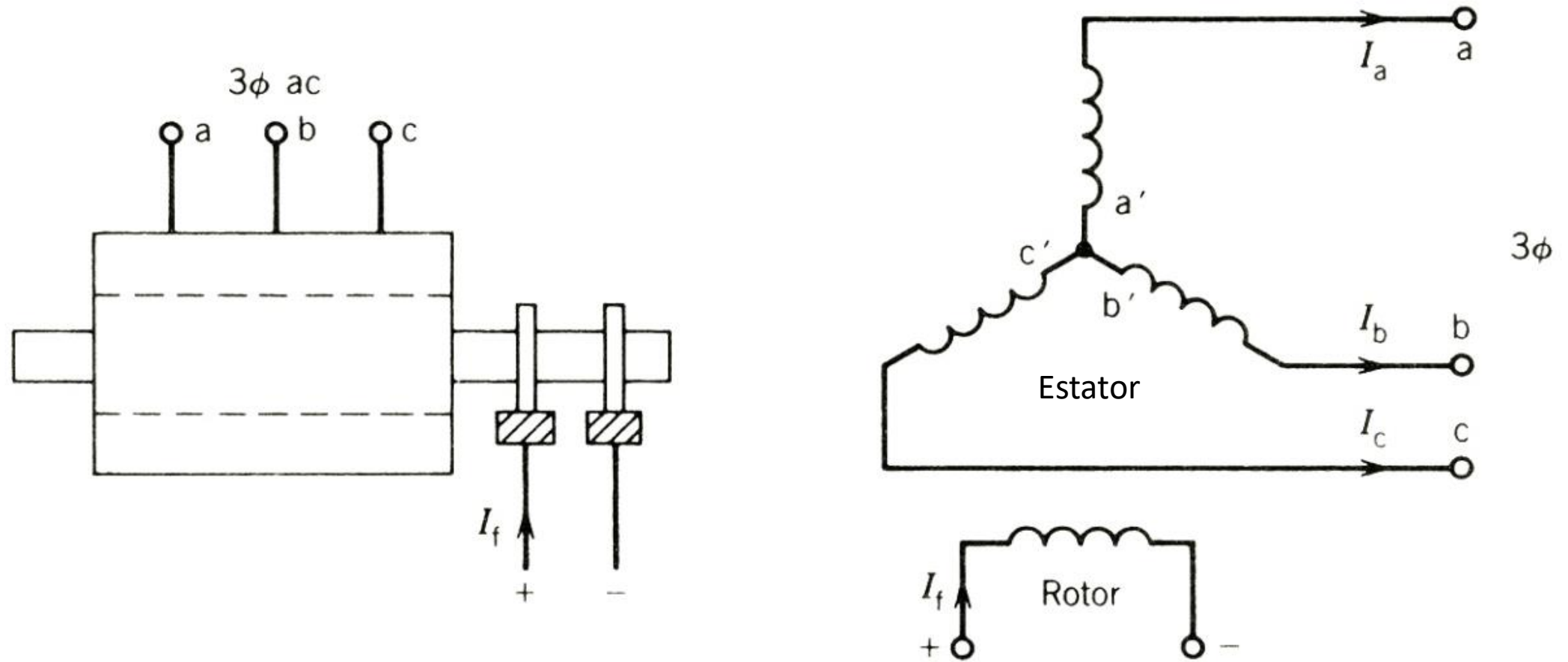
Classificação das Máquinas Elétricas Rotativas



Características da máquina síncrona trifásica

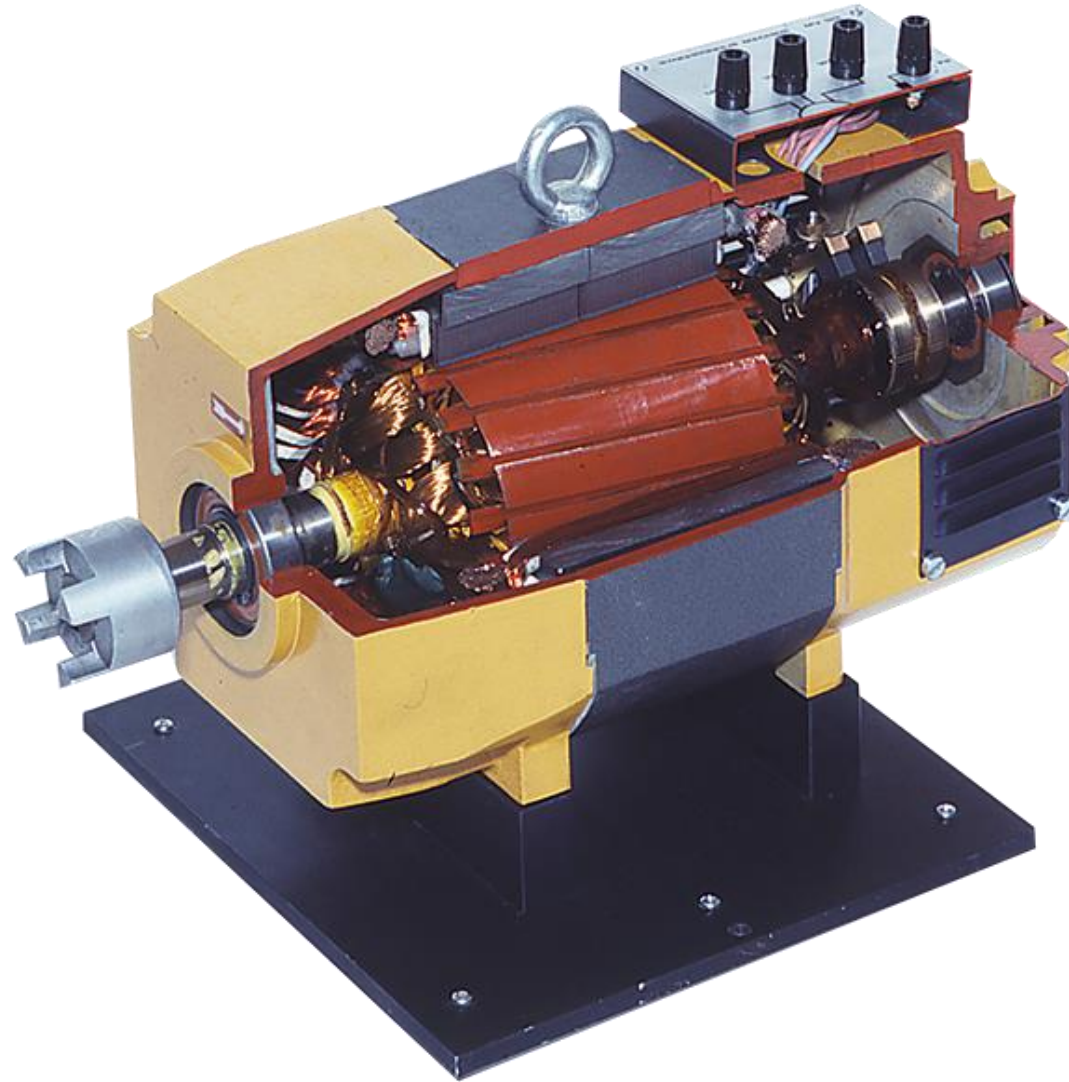
- ❑ Estator trifásico similar a máquina de indução;
- ❑ Circuito de rotor alimentado em corrente contínua ou presença de ímãs permanentes;
- ❑ Velocidade essencialmente constante; 
- ❑ Pode operar com fator de potência indutivo ou capacitivo;
- ❑ Popular no sistema elétrico como gerador;
- ❑ É capaz de prover compensação de potência reativa.

Estrutura interna da máquina síncrona



Fonte: P. C. Sen. "Principles of Electrical Machines and Power Electronics".

Estrutura interna da máquina síncrona




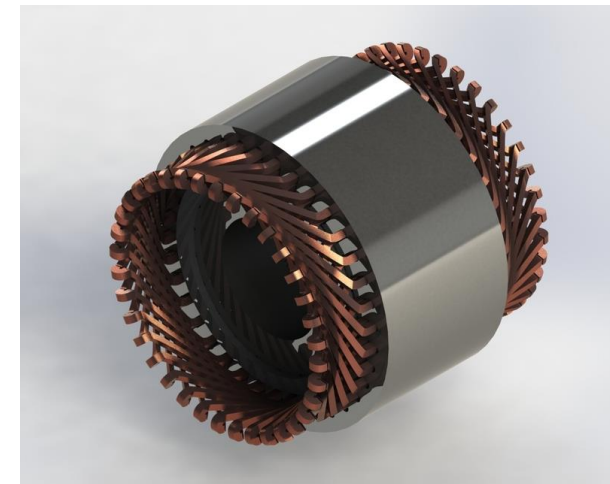
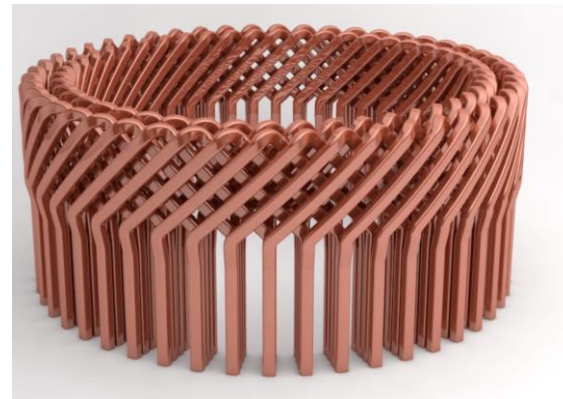
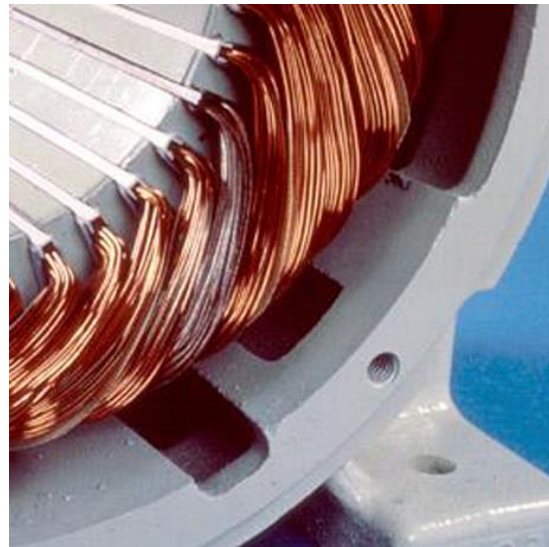
Terco. MV1008-C Synchronous Machine

Estator

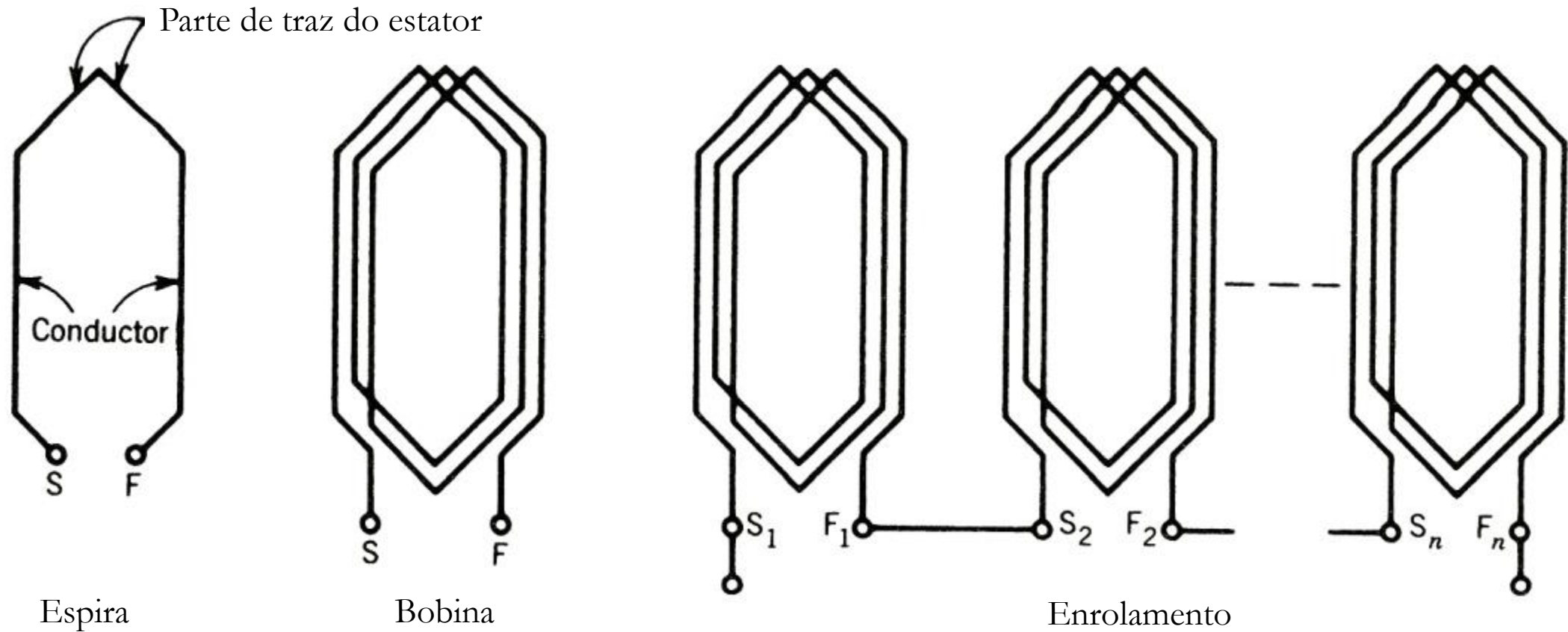


Partes constituintes: Bobinas

- ❑ Tipicamente utilizam cobre;
- ❑ Utilizam-se fios esmaltados ou barras de cobre → isolação elétrica; 
- ❑ Isolação → Limita a temperatura máxima de operação do equipamento.

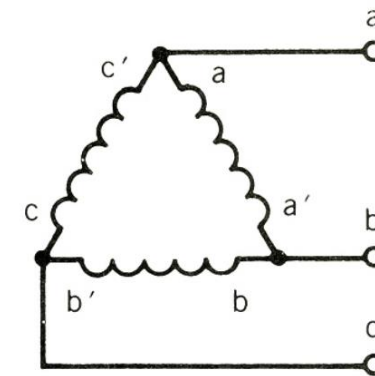
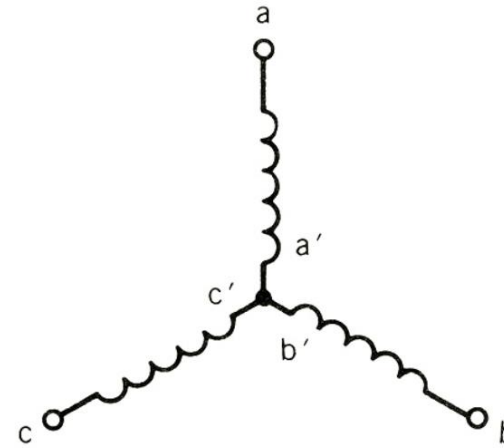
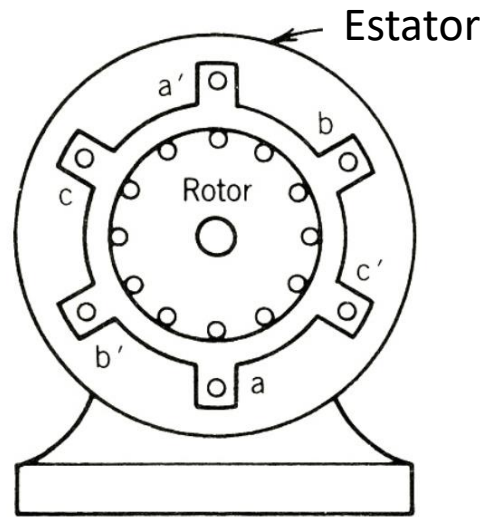


Partes constituintes: Bobinas

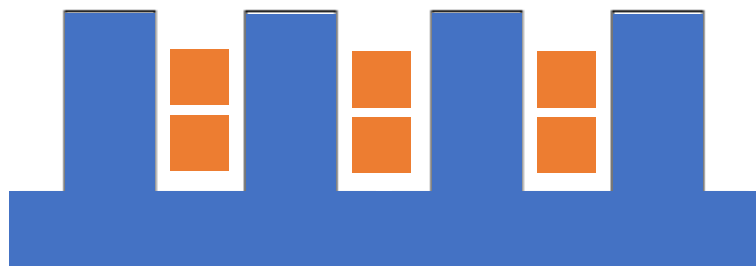


Fonte: P. C. Sen. "Principles of Electrical Machines and Power Electronics".

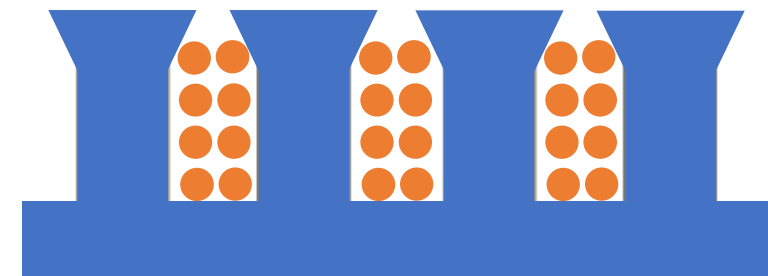
Enrolamentos da máquina



Fonte: P. C. Sen. "Principles of Electrical Machines and Power Electronics".



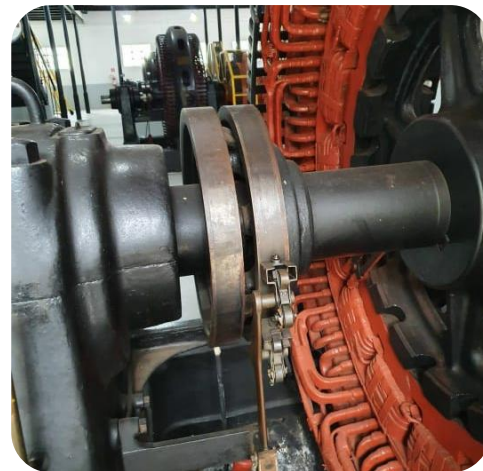
Ranuras abertas



Ranuras semi-fechadas

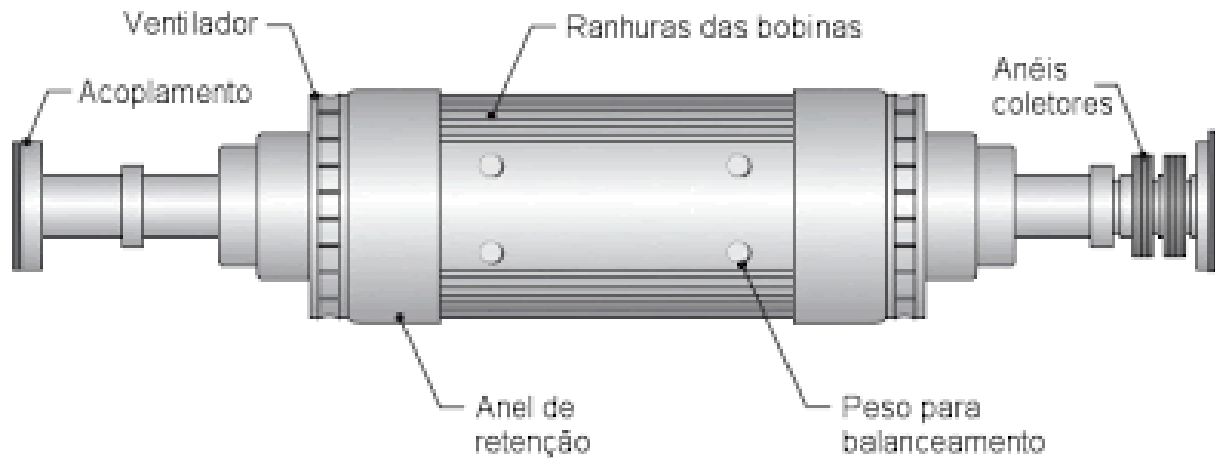
Rotor bobinado

- ❑ Alimentado em corrente contínua;
- ❑ Presença de anéis coletores e escovas;
- ❑ Ponto que requer manutenção.

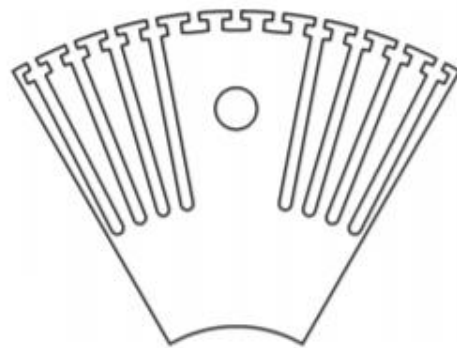


Fonte: P. C. Sen. "Principles of Electrical Machines and Power Electronics".

Rotor de polos lisos

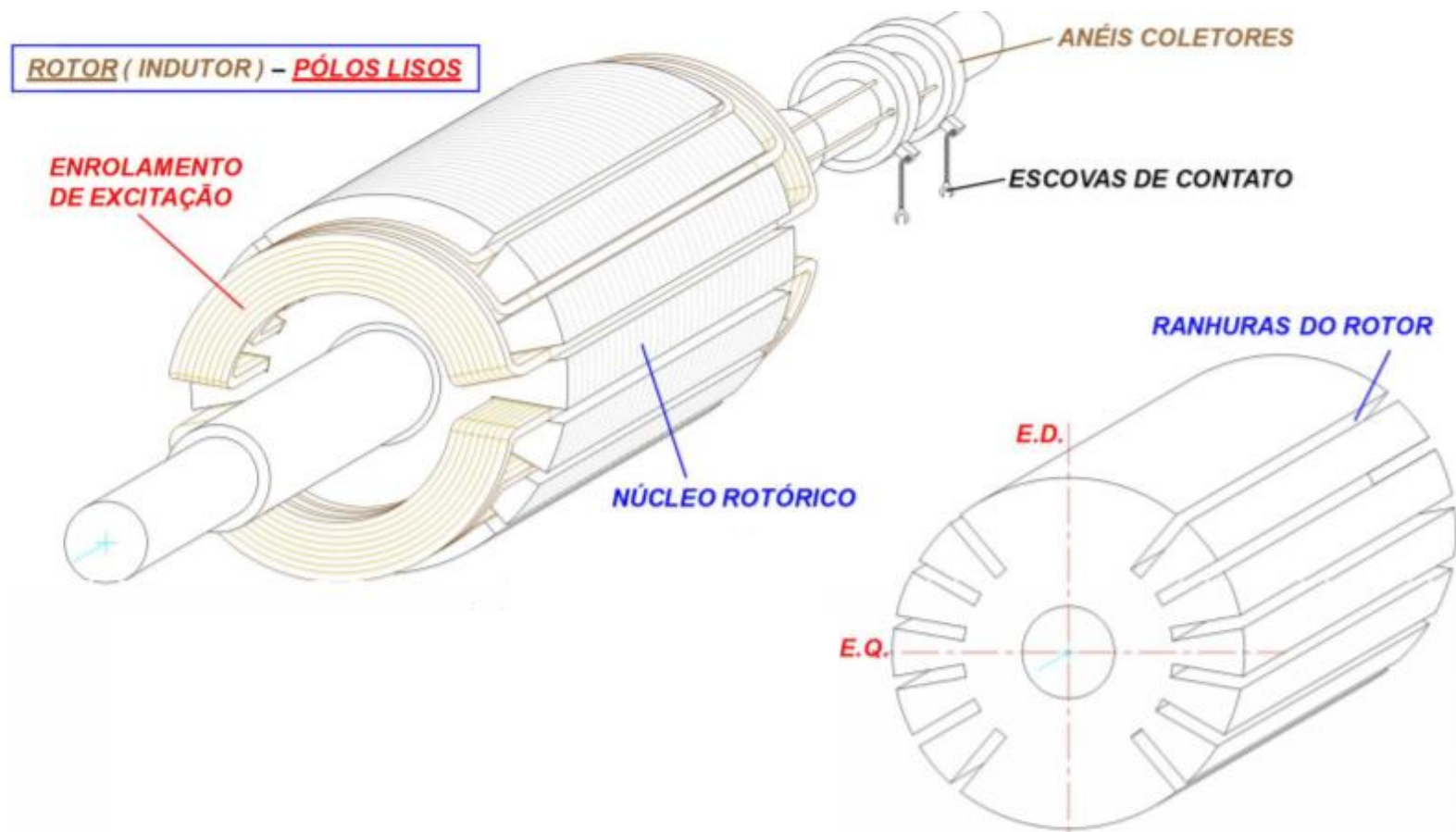


<http://maquinas-utfpr.blogspot.com/2012/07/links-atualizados.html>



F. Kutt, M. Michna and G. Kostro. Non-Salient Brushless Synchronous Generator Main Exciter Design for More Electric Aircraft. Energies 2020, 13(11), 2696

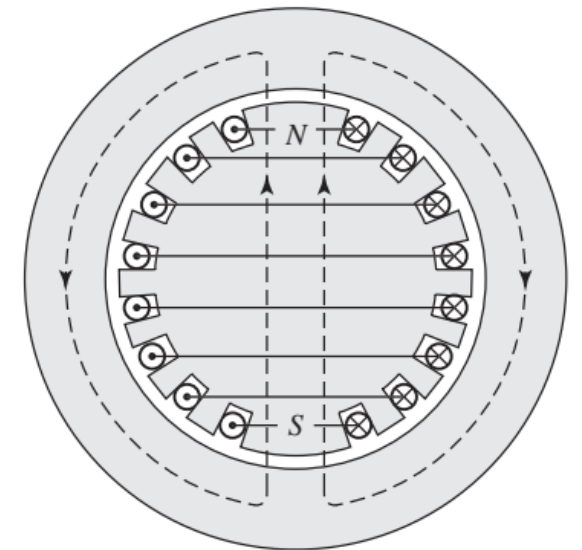
Rotor de polos lisos



Notas de aula da disciplina PEA3400 - Máquinas Elétricas I da USP. 2019

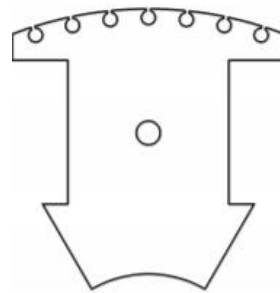
Rotor de polos lisos

- ❑ Utilizada em máquinas de alta velocidade;
- ❑ Número reduzido de polos;
- ❑ Pequena circunferência e comprimento axial elevado.



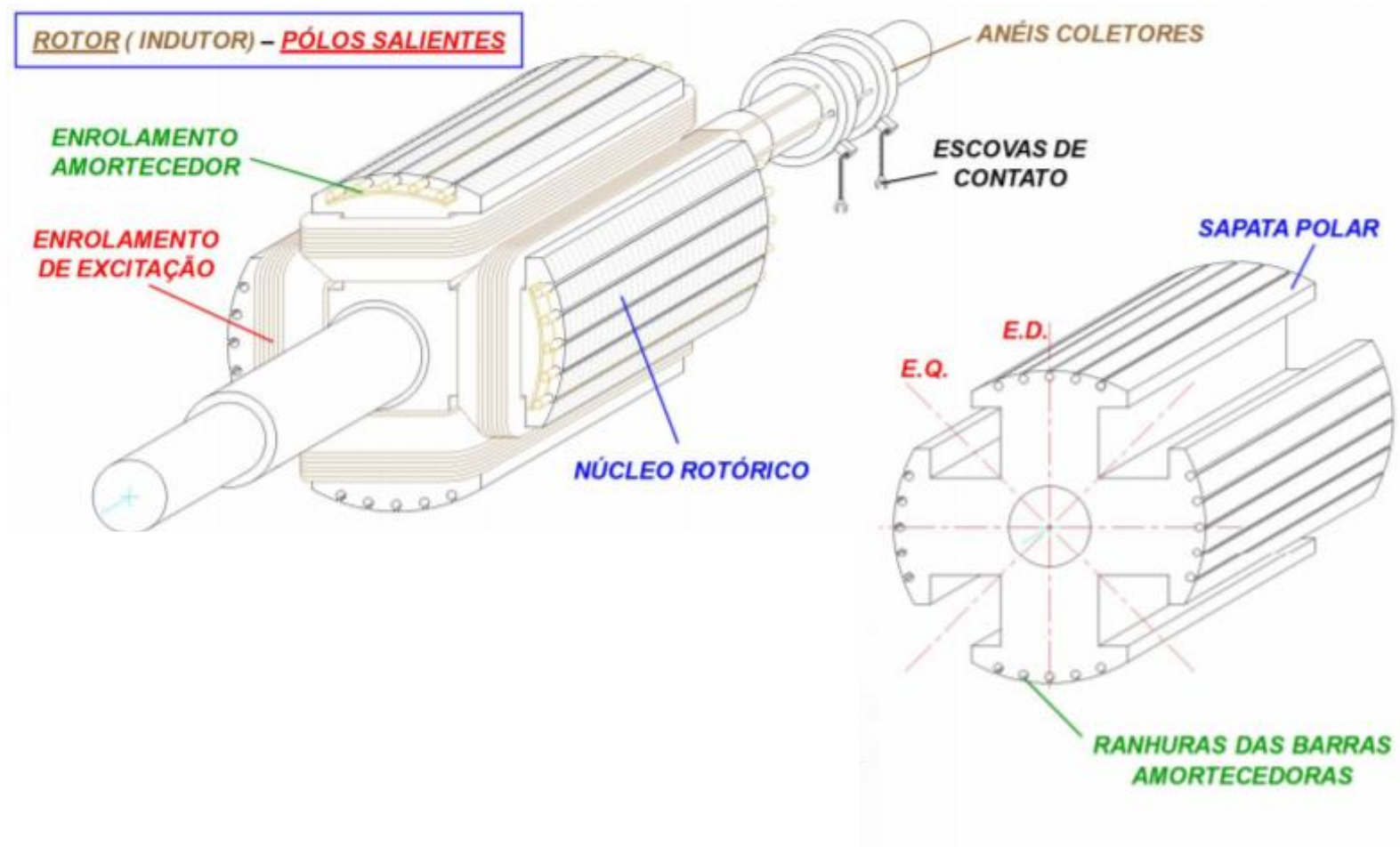
Fonte: Fitzgerald e Kingsley. “Máquinas Elétricas”.

Rotor de polos salientes



F. Kutt, M. Michna and G. Kostro. Non-Salient Brushless Synchronous Generator Main Exciter Design for More Electric Aircraft. Energies 2020, 13(11), 2696

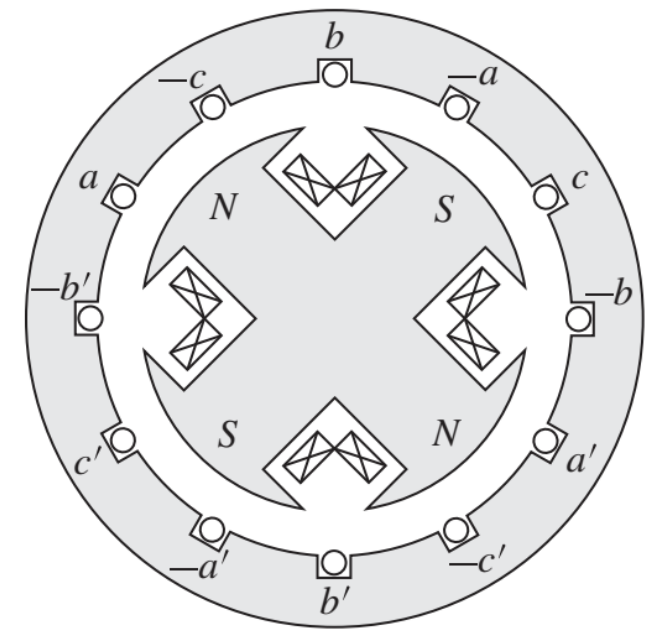
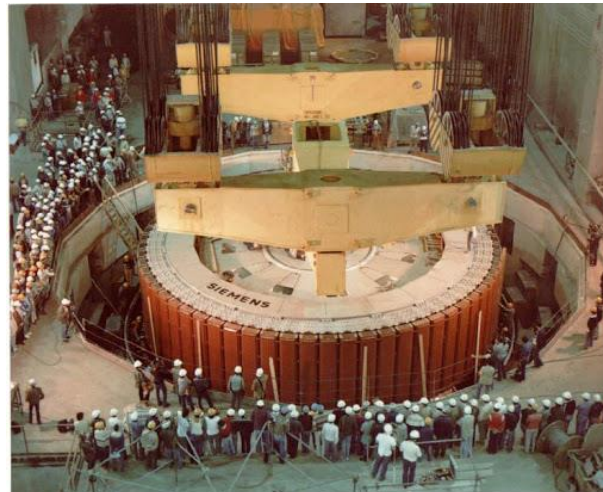
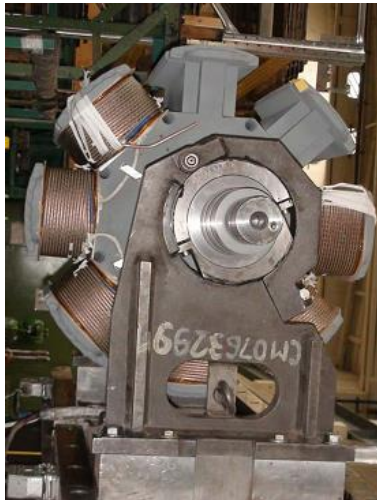
Rotor de polos salientes



Notas de aula da disciplina PEA3400 - Máquinas Elétricas I da USP. 2019

Rotor de polos salientes

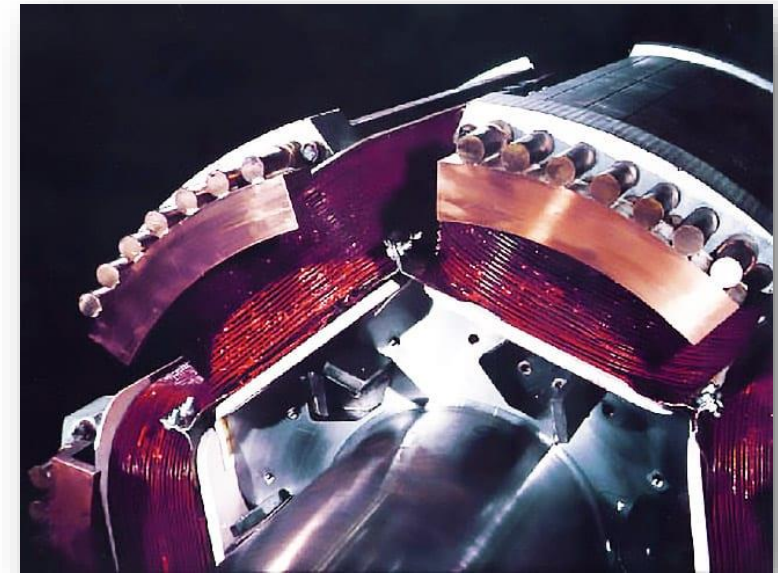
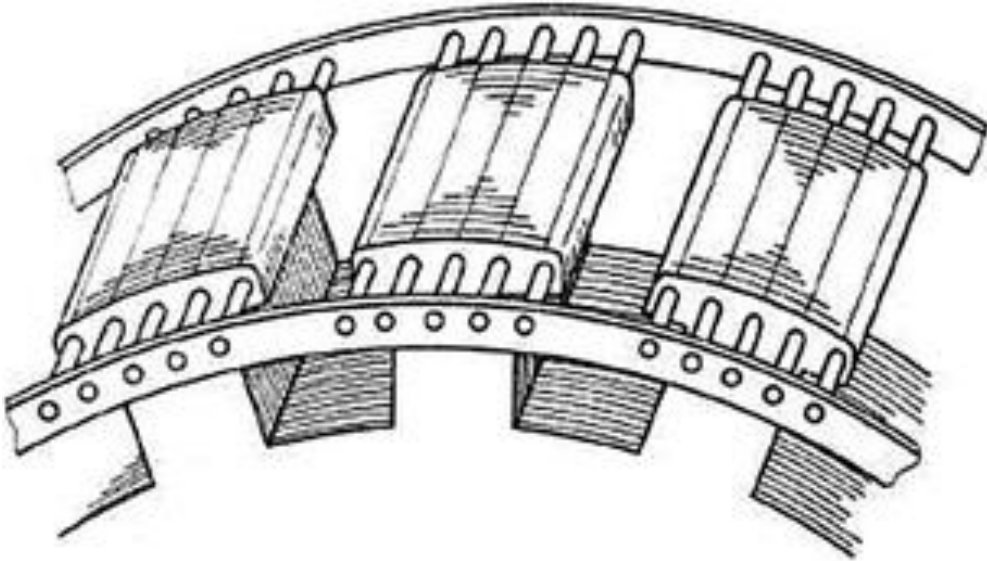
- ❑ Utilizada em máquinas de baixa velocidade;
- ❑ Número elevado de pólos;
- ❑ Grande circunferência e comprimento axial reduzido.



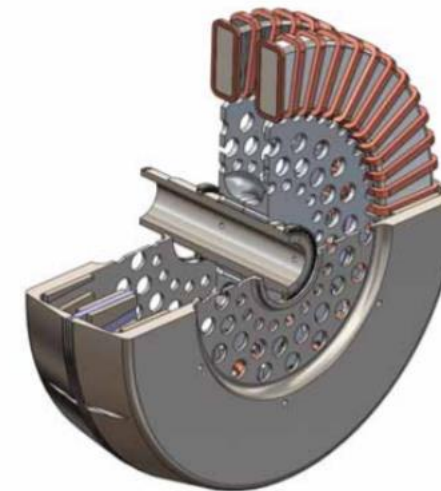
Fonte: Fitzgerald e Kingsley. "Máquinas Elétricas".

Enrolamento Amortecedor

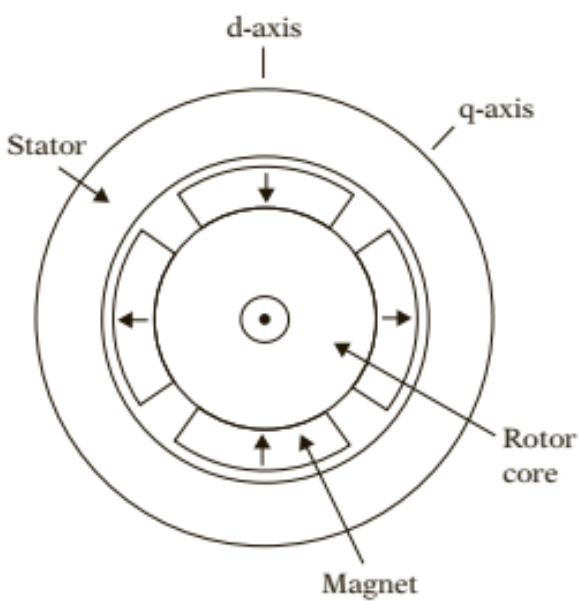
- ❑ Utilizado como mecanismo de partida em motores síncronos;
- ❑ Garante o amortecimento de oscilações durante transitórios;
- ❑ “Gaiola de esquilo” instalada na estrutura de rotor da máquina síncrona.



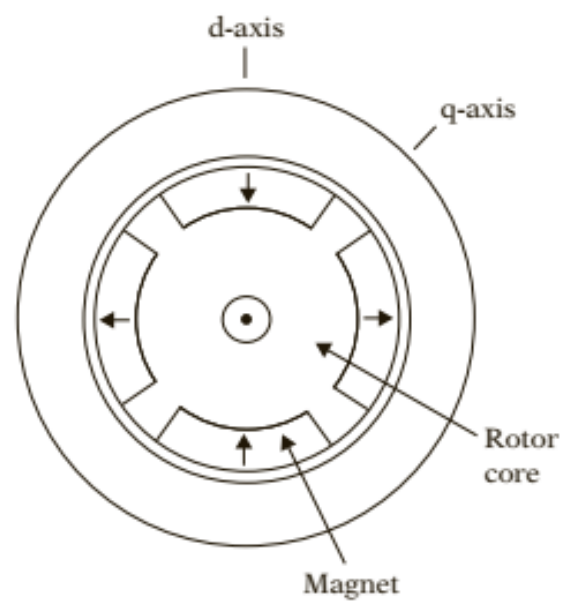
Rotor baseado em ímãs permanentes



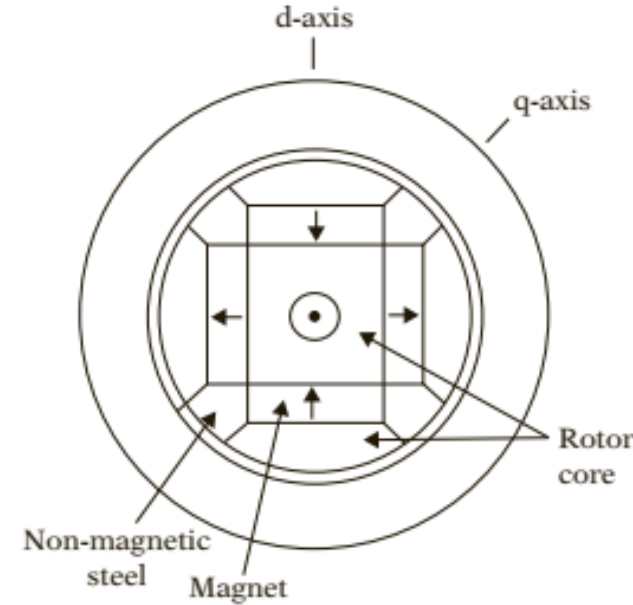
Rotor baseado em ímãs permanentes



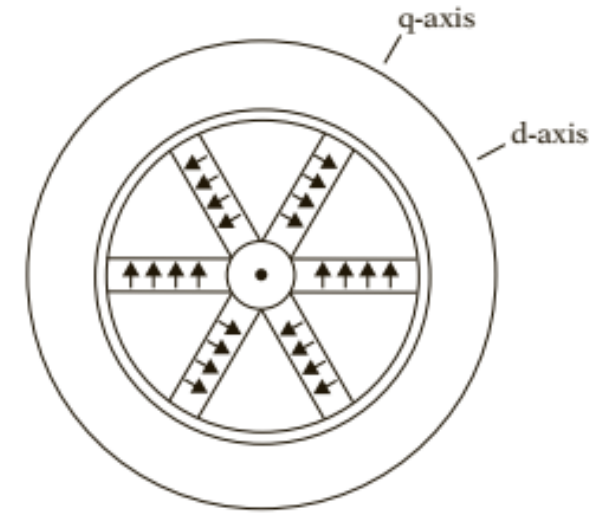
Ímã na superfície



Ímã parcialmente fixado



Ímã embutido (fluxo radial)



Ímã embutido (fluxo circular)

Fonte: P. C. Sen. "Principles of Electrical Machines and Power Electronics".

Obrigado pela Atenção



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