point was found to lie on the straight line obtained from Eq. 3.16. The curved parts of the characteristics were calculated by using Eqs. 3.9 and 3.11 to 3.14. The break points in Fig. 3.8 show that, except for operation at extreme values of α, current is discontinuous for torques up to rated value.

The curves in Fig. 3.8 also show that no reasonable amount of approximation can produce a linear transfer function for the converter-motor combination.

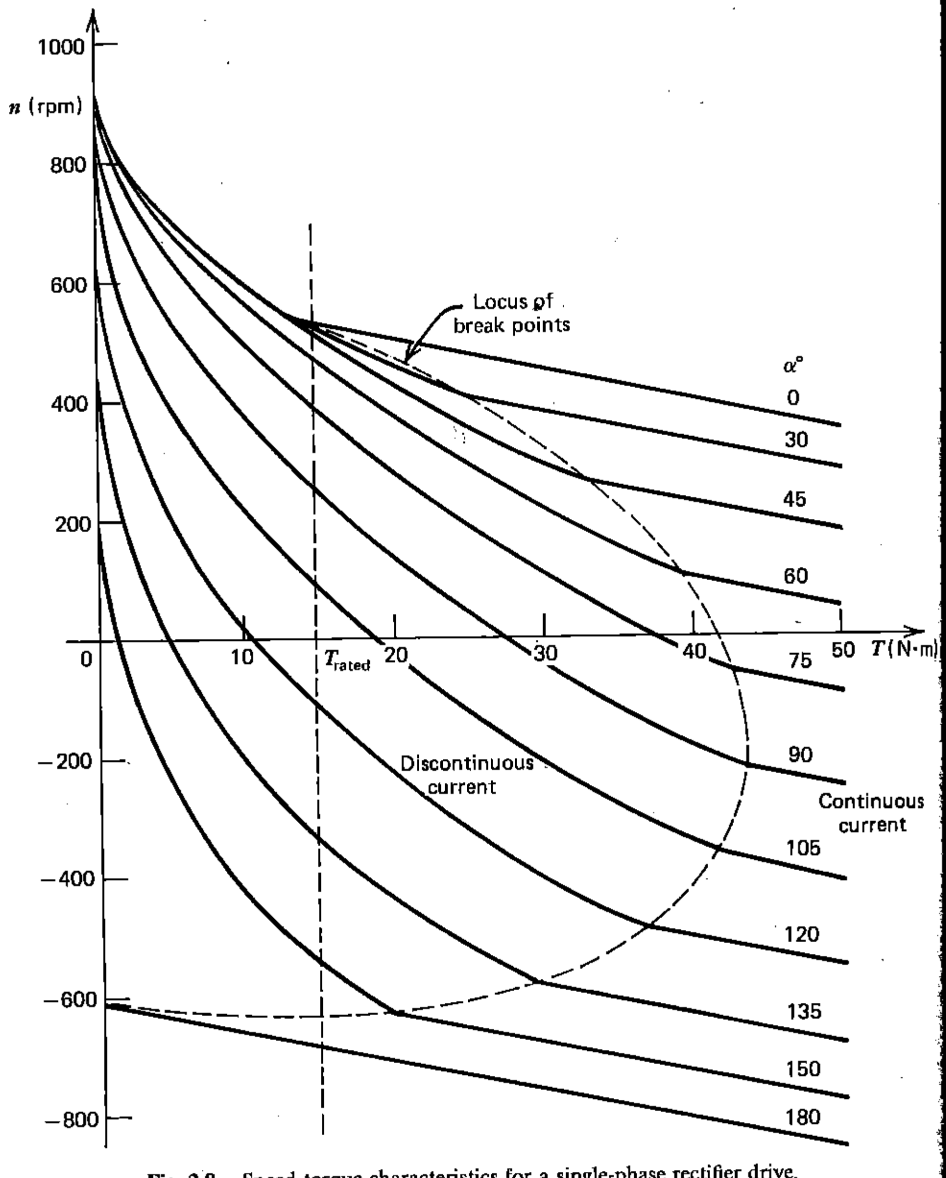

Fig. 3.8. Speed-torque characteristics for a single-phase rectifier drive.

tion. If a stability analysis is
analog computer. When a sim
behavior of the system for disc
continuous current and that it
will operate satisfactorily on b

Continuous-current operat
inductance in the motor arm
ensure continuous-current op
Other converter configuration
inductor considerably, even if

3.2.

The converters in Fig. 3.1 ca
motor acting as a generator a
current i_a cannot reverse, the
invert without change of ar
current or direction of rotat
negative and, in effect, operat
Fig. 3.8.

Figure 3.9 shows wavefo
current and Fig. 3.10 illustrate
gating signals are extended. Ex
for all conditions of inverter o
change in $\bar{v}_t$ takes place on tra
or conversely.[3] Figure 3.11
continuous current in which t
v_{AKA}. Time t_q is the time ava
essential that $\omega t_q \geq \omega t_{\text{off}} + \mu$,
of the converter and μ is the
continuous current when $\alpha >$
marked $\alpha = 180°$ in Fig. 3.8 i
drive and should be replaced b

Example 3.1

The 230-V, 850-rpm, frame-si
drive an antenna. The loss tor
proportional to speed; that of
motor armature is supplied fr
and the ac supply of the rectif
the value that gives rated spee

Determine $\bar{i}_a$, $\bar{v}_t$, and α wh
rated speed.

A family of speed-torque characteristics for a three-phase drive similar to those shown in Fig. 3.8 for a single-phase drive may be constructed by a procedure similar to that described at the end of Section 3.2.

Equations 3.5 and 3.9 may be applied to discontinuous-current operation of a three-phase, bridge-rectifier drive, provided that α is replaced by $\alpha + \pi/3$ in both equations, and, for the point of transition from continuous to discontinuous-current operation, β is replaced by $\alpha + 2\pi/3$ in Eq. 3.9. This last equation may then be used to calculated Ω_m at transition for a series of values

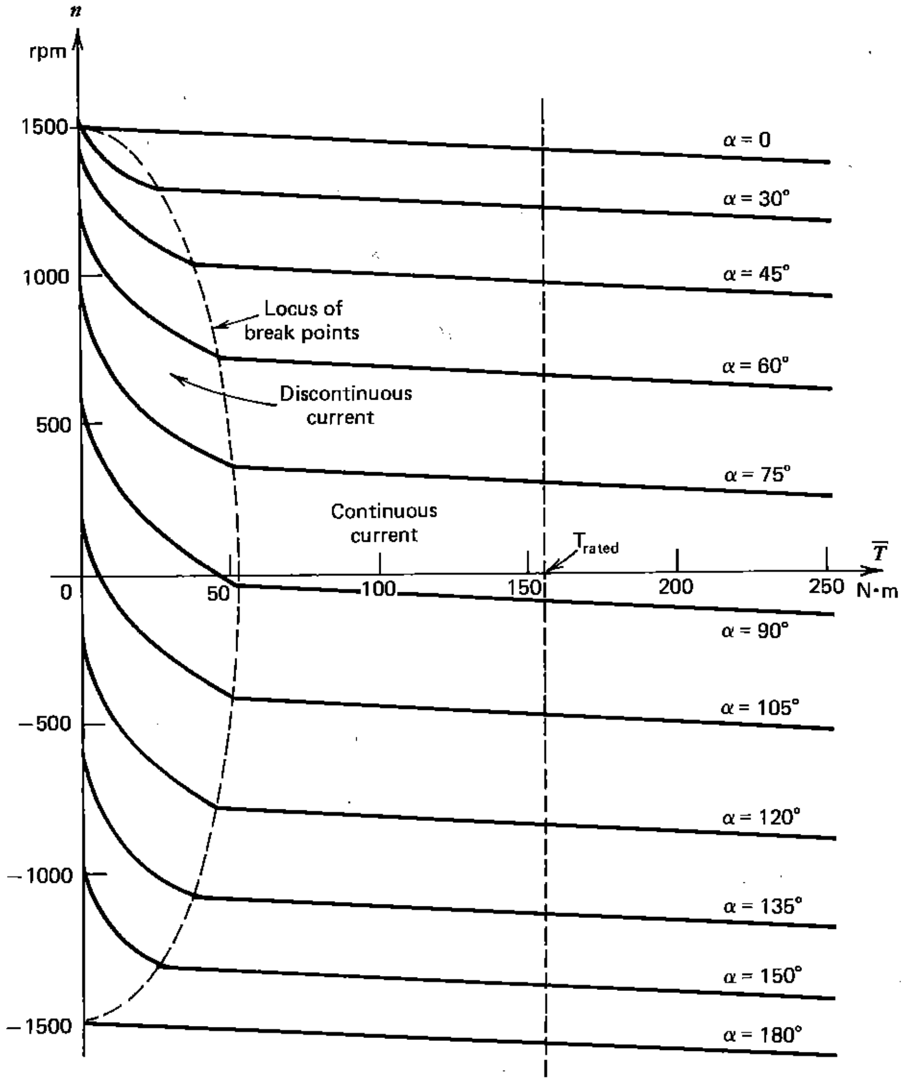

Fig. 4.4. Speed-torque characteristics for a three-phase rectifier drive.

of α. The corresponding value
Eqs. 4.3 to 4.5. The point o
Eq. 4.7.

Once again, the point on tl

$$\hat{v}_t = \sqrt{2}\, V \text{ V}$$

$$\hat{v}_t = \sqrt{2}\, V \sin|$$

and

Figure 4.4 shows a family
230-V, 25-hp, frame-size 366
excited by a three-phase brid
value of α. The rectifier was s
field current was set at the va
dc source. These characteristi
range current is continuous.
indicates that break-point to
speed or at approximately α =

Example 4.1

For the motor in Fig. 4.4 de
torque of doubling the armat

Solution

The motor parameters are n
$I_R = 92$ A and

rated speed = 1150 rp

$$k\Phi = \frac{230 -}{1}$$

$$Z = \left[(120\pi\right.$$

$$\tan\varphi = \frac{120\pi \times}{}$$

$$\varphi = 85.10°$$