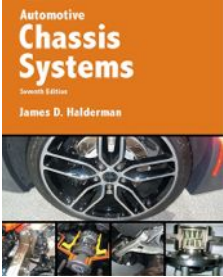


Automotive Chassis Systems



CHAPTER 20

Regenerative Braking Systems

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FIGURE 20.1 This Honda Insight hybrid electric vehicle is constructed mostly of aluminum to save weight.



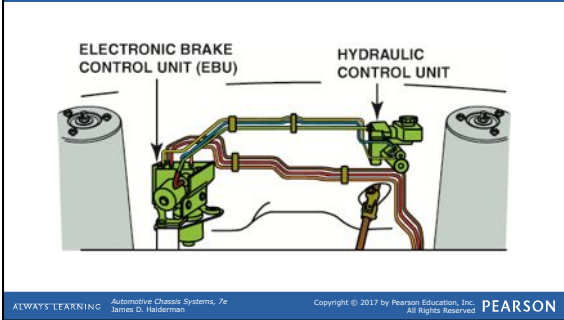
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FIGURE 20.2 A Toyota Prius hybrid electric vehicle. This sedan weighs more and therefore has greater kinetic energy than a smaller, lighter vehicle.



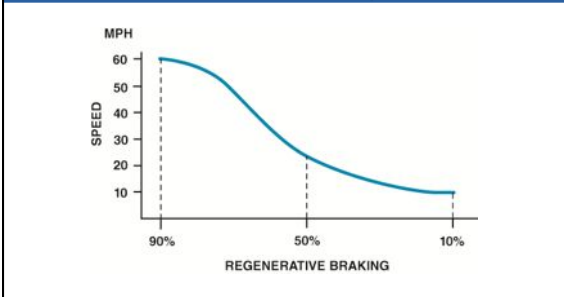
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FIGURE 20.3 The electronic brake control unit (EBU) is shown on the left (passenger side) and the brake hydraulic unit is shown on the right (driver's side) on this Ford Escape system.



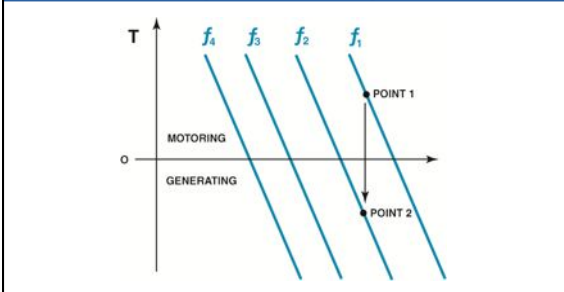
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FIGURE 20.4 A typical brake curve showing the speed on the left and the percentage of regenerative braking along the bottom. Notice that the base brakes are being used more when the vehicle speed is low.



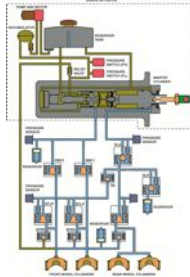
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FIGURE 20.5 The frequency ("f") applied to the stator windings of an AC synchronous motor can be varied to create either forward torque ("T") or regenerative braking.



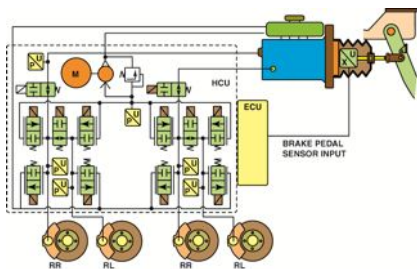
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FIGURE 20.6 The Toyota Prius regenerative braking system component showing the master cylinder and pressure switches.



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FIGURE 20.7 The Ford Escape regenerative braking system, showing all of the components.



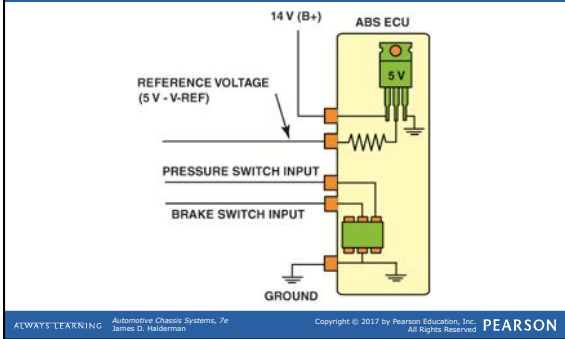
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FIGURE 20.8 The “B” position on the shift display on this Lexus RX 400h means braking. This shifter position can be selected when descending long hills or grades.



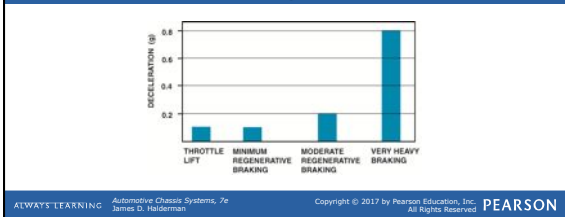
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FIGURE 20.9 The ABS ECU on a Toyota Prius uses the brake switch and pressure sensor inputs to control the regenerative braking system.



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FIGURE 20.10 This graph compares the figures: at the far left, a throttle lift typically giving about 0.1 g deceleration; second from the left, a minimum regenerative braking of about 0.1 g; second from the right, a moderate regenerative braking is about 0.2 g; and on the far right, a hard emergency stop resulting in braking of (at least) 0.8 g, which uses both the regenerative braking system and the base hydraulic brake system.



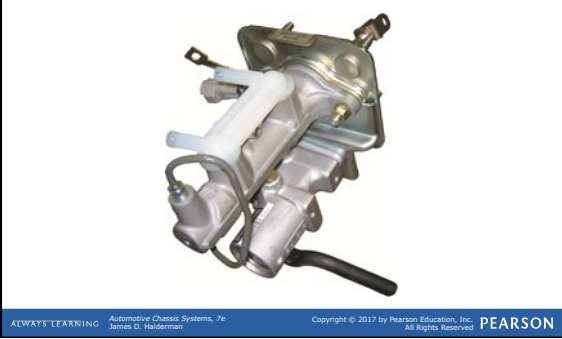
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FIGURE 20.11 This Honda valve train photo shows the small spring used to absorb the motion of the rocker arm when the cam is switched to a lobe that has zero lift.



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FIGURE 20.12 A master cylinder from a Toyota Highlander hybrid electric vehicle.



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FIGURE 20.13 When working on the brakes on a Ford Escape or Mercury Mariner hybrid vehicle, disconnect the black electrical connector on the ABS hydraulic control unit located on the passenger side under the hood.



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