# Notes on ”The art of the helicopter”

p.35. Compressibility is the effect that drag on the rotorblade tips increases disproportionally when nearing Mach 1, due to disturbances ahead of the blade caused by sound waves travelling only slightly faster than the blade itself. This especially occurs in extremly cold weather or at high altitude, when the speed of sound drops. Equation: V = gas constant x sqrt(T) where T is absolute temperature. Also see fig 2.14. High speed objects causing shock waves, because the speed of sound increases on positive half cycles (recall speed is a function of temperature).

p.39 . Static and dynamic balance of rotor blades  
p.262. Autopilot stability system, the pilot only has indirect control of the aircraft

## Flight sensors (p.263)

p.263. Magnetic compass are inaccurate when banking or accelerating, due to downward slope (dip) of magnetic field. Instead gyros are used, which are periodically reset to an accurate compass reading (level, straight flight)  
  
Altitude (height)  
Altimeter senses height but must be calibrated to a reference (ground, sea..)  
 - Aneroid barometer (no fluid) and relative pressure to reference  
RADAR is used to measure height above ground.  
GPS can also be used, but has inaccuracies.  
Vertical speed indicator measures rate of change in air pressure.

### Air speed

Air speed indicator (ASI) measures dynamic air pressure caused by forward motion (p.271 pressure of pitot head vs. static vents and compensation of asymmetric airflow : figure 7.8)  
Doppler RADAR can measure ground velocity

### Attitude (orientation)

Pitch and roll commonly measured by gyroscopic devices

### Magnetic compass p.267

Closer to the north or south pole the magnetic field dips towards the ground.  
Magnetic pole and real pole does not match, and the field wanders slightly.  
External magnetic sources may induce errors (magnetos?, alternator?, electric fuel pump, trim motors, gyroscopic instruments, headset coils)  
Nearby ferrous components may alter the local magnetic field (most metal parts) (figure p.266)  
Calibration and deviation card (”swing the compass”)  
Acceleration and orientation causes errors due to magnetic field dip (two examples + p.268 list)  
Flux Gate Compass, positioned on the wing tip or tail boom (p.269)