VVT technology

- Variable cam phasing
  - Many companies (Fiat, Nissan, Toyota …)

- Cam switching
  - Honda VTEC

- Valve-lift geometry control
  - BMW Valvetronic

- Hydraulic/electro-hydraulic lift control
  - Jacobs VVT
  - Lotus/Eaton

- Electromagnetic valve
  - FEV EMV, Visteon EVA
VVT technology

Toyota VVT-i
(SAE Paper 960579)
Honda VTEC (SAE 910008)

Nissan NVCS (SAE 910677)

Figure 11 Configuration of NVCS
NVCS (Nissan Valve timing Control System)
BMW Valvetronic

Motor drive for eccentric shaft

(a) Eccentric shaft

(b) Input cam

intermediate lever

(c) cam roller follower

AEI, February 2003
The Jacobs VVT – loss motion system

Figure 2. Lost-motion valve lift profiles. Centered valve lift is generated by absorbing the first portion of valve motion. Early valve closing is generated by releasing hydraulic link in valve train.
Lotus/Eaton electro-hydraulic system

AVT Operation

Pressure → Return

Switching Valve (SV)

Actuator Valve (AV)

Actuator with Integral Displacement Transducer

Conventional Poppet Valve and Spring
Electromagnetic Valves

• Advantage
  – flexibility

• Challenges
  – Significant force required
    • $F \propto (\text{RPM})^2$
  – Seating velocity
  – Noise
  – Packaging
  – Cost