Brushless-DC Motor 4: Commutation – Trapezoidal Control

TI Precision Labs – Motor Drivers

Presented and prepared by Mostafa Shubbar
BLDC fundamentals

BLDC Motor BEMF
Basics of trapezoidal commutation

+ Low Cost
+ Simple to implement
+ Less processing power
+ High speed applications

– Electric and acoustic noise
– Torque ripple
Basics of trapezoidal commutation
Sensored trapezoidal commutation

6-Step trapezoidal control using hall sensors

Hall A
Hall B
Hall C

Hall sensor output

1
0

Hall A
Hall B
Hall C

N = H
S = L

Hall sensor

U
V
W

Hall sensor output

1
0
Sensored trapezoidal commutation

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<th>Hall C</th>
<th>U</th>
<th>V</th>
<th>W</th>
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Phase U

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Phase V

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Phase W

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N = H
S = L
Sensorless trapezoidal commutation

6-step trapezoidal control using back-EMF

Phase U: + + Z - - Z
Phase V: Z + + Z -
Phase W: Z - - Z + +

Initial Position Detection (IPD) – detect initial position without rotation
Rotor Align – Rotor aligns to known position, sometimes causing reverse rotation at startup

Back-EMF waveforms for 3-phase system

Back-EMF waveforms for 3-phase system
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