

**Supplementary Materials S1.** All permutations of code changes corresponding to multi-valued logic trees 1, 2, 3

Lp	x <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>5</sub>	Lp	x <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>	x <sub>5</sub>	x <sub>4</sub>	Lp	x <sub>1</sub>	x <sub>2</sub>	x <sub>4</sub>	x <sub>3</sub>	x <sub>5</sub>
1						2						3					

4, 5, 6

Lp	x <sub>1</sub>	x <sub>2</sub>	x <sub>5</sub>	x <sub>3</sub>	x <sub>4</sub>	Lp	x <sub>1</sub>	x <sub>2</sub>	x <sub>4</sub>	x <sub>5</sub>	x <sub>3</sub>	Lp	x <sub>1</sub>	x <sub>2</sub>	x <sub>5</sub>	x <sub>4</sub>	x <sub>3</sub>
4						5						6					

7, 8, 9

Lp	x <sub>1</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>5</sub>	x <sub>2</sub>	Lp	x <sub>1</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>2</sub>	x <sub>5</sub>	Lp	x <sub>1</sub>	x <sub>3</sub>	x <sub>5</sub>	x <sub>4</sub>	x <sub>2</sub>
7						8						9					

10, 11, 12

Lp	x <sub>1</sub>	x <sub>3</sub>	x <sub>2</sub>	x <sub>4</sub>	x <sub>5</sub>	Lp	x <sub>1</sub>	x <sub>3</sub>	x <sub>5</sub>	x <sub>2</sub>	x <sub>4</sub>	Lp	x <sub>1</sub>	x <sub>3</sub>	x <sub>2</sub>	x <sub>5</sub>	x <sub>4</sub>
10						11						12					

13, 14, 15

Lp	x <sub>1</sub>	x <sub>4</sub>	x <sub>5</sub>	x <sub>2</sub>	x <sub>3</sub>	Lp	x <sub>1</sub>	x <sub>4</sub>	x <sub>5</sub>	x <sub>3</sub>	x <sub>2</sub>	Lp	x <sub>1</sub>	x <sub>4</sub>	x <sub>2</sub>	x <sub>5</sub>	x <sub>3</sub>
13						14						15	0	0	0	0	0

16, 17, 18

Lp	x <sub>1</sub>	x <sub>4</sub>	x <sub>3</sub>	x <sub>5</sub>	x <sub>2</sub>	Lp	x <sub>1</sub>	x <sub>4</sub>	x <sub>2</sub>	x <sub>3</sub>	x <sub>5</sub>	Lp	x <sub>1</sub>	x <sub>4</sub>	x <sub>3</sub>	x <sub>2</sub>	x <sub>5</sub>
16						17						18					

19, 20, 21

Lp	x <sub>1</sub>	x <sub>5</sub>	x <sub>2</sub>	x <sub>3</sub>	x <sub>4</sub>	Lp	x <sub>1</sub>	x <sub>5</sub>	x <sub>2</sub>	x <sub>4</sub>	x <sub>3</sub>	Lp	x <sub>1</sub>	x <sub>5</sub>	x <sub>3</sub>	x <sub>2</sub>	x <sub>4</sub>
19						20						21					

22, 23, 24

Lp	x <sub>1</sub>	x <sub>5</sub>	x <sub>4</sub>	x <sub>2</sub>	x <sub>3</sub>	Lp	x <sub>1</sub>	x <sub>5</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>2</sub>	Lp	x <sub>1</sub>	x <sub>5</sub>	x <sub>4</sub>	x <sub>3</sub>	x <sub>2</sub>
22						23						24					

25, 26, 27

Lp	x <sub>2</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>5</sub>	x <sub>1</sub>	Lp	x <sub>2</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>1</sub>	x <sub>5</sub>	Lp	x <sub>2</sub>	x <sub>3</sub>	x <sub>5</sub>	x <sub>4</sub>	x <sub>1</sub>
25						26						27					

28, 29, 30

Lp	x <sub>2</sub>	x <sub>3</sub>	x <sub>1</sub>	x <sub>4</sub>	x <sub>5</sub>	Lp	x <sub>2</sub>	x <sub>3</sub>	x <sub>5</sub>	x <sub>1</sub>	x <sub>4</sub>	Lp	x <sub>2</sub>	x <sub>3</sub>	x <sub>1</sub>	x <sub>5</sub>	x <sub>4</sub>
28						29						30					

31, 32, 33

Lp	x <sub>2</sub>	x <sub>4</sub>	x <sub>5</sub>	x <sub>1</sub>	x <sub>3</sub>	Lp	x <sub>2</sub>	x <sub>4</sub>	x <sub>5</sub>	x <sub>3</sub>	x <sub>1</sub>	Lp	x <sub>2</sub>	x <sub>4</sub>	x <sub>1</sub>	x <sub>5</sub>	x <sub>3</sub>
31						32						33					

34, 35, 36

Lp	x <sub>2</sub>	x <sub>4</sub>	x <sub>3</sub>	x <sub>5</sub>	x <sub>1</sub>	Lp	x <sub>2</sub>	x <sub>4</sub>	x <sub>1</sub>	x <sub>3</sub>	x <sub>5</sub>	Lp	x <sub>2</sub>	x <sub>4</sub>	x <sub>3</sub>	x <sub>1</sub>	x <sub>5</sub>
34						35						36					

37, 38, 39

Lp	x <sub>2</sub>	x <sub>5</sub>	x <sub>1</sub>	x <sub>3</sub>	x <sub>4</sub>	Lp	x <sub>2</sub>	x <sub>5</sub>	x <sub>1</sub>	x <sub>4</sub>	x <sub>3</sub>	Lp	x <sub>2</sub>	x <sub>5</sub>	x <sub>3</sub>	x <sub>1</sub>	x <sub>4</sub>
37						38						39					

40, 41, 42

Lp	x <sub>2</sub>	x <sub>5</sub>	x <sub>4</sub>	x <sub>1</sub>	x <sub>3</sub>	Lp	x <sub>2</sub>	x <sub>5</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>1</sub>	Lp	x <sub>2</sub>	x <sub>5</sub>	x <sub>4</sub>	x <sub>3</sub>	x <sub>1</sub>
40						41						42					

43, 44, 45

Lp	x <sub>2</sub>	x <sub>1</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>5</sub>	Lp	x <sub>2</sub>	x <sub>1</sub>	x <sub>3</sub>	x <sub>5</sub>	x <sub>4</sub>	Lp	x <sub>2</sub>	x <sub>1</sub>	x <sub>4</sub>	x <sub>3</sub>	x <sub>5</sub>
43						44						45					

46, 47, 48

Lp	x <sub>2</sub>	x <sub>1</sub>	x <sub>5</sub>	x <sub>3</sub>	x <sub>4</sub>	Lp	x <sub>2</sub>	x <sub>1</sub>	x <sub>4</sub>	x <sub>5</sub>	x <sub>3</sub>	Lp	x <sub>2</sub>	x <sub>1</sub>	x <sub>5</sub>	x <sub>4</sub>	x <sub>3</sub>
46						47						48					

49, 50, 51

Lp	x <sub>3</sub>	x <sub>4</sub>	x <sub>5</sub>	x <sub>1</sub>	x <sub>2</sub>	Lp	x <sub>3</sub>	x <sub>4</sub>	x <sub>5</sub>	x <sub>2</sub>	x <sub>1</sub>	Lp	x <sub>3</sub>	x <sub>4</sub>	x <sub>1</sub>	x <sub>5</sub>	x <sub>2</sub>
49						50						51					

52, 53, 54

Lp	x <sub>3</sub>	x <sub>4</sub>	x <sub>2</sub>	x <sub>5</sub>	x <sub>1</sub>	Lp	x <sub>3</sub>	x <sub>4</sub>	x <sub>1</sub>	x <sub>2</sub>	x <sub>5</sub>	Lp	x <sub>3</sub>	x <sub>4</sub>	x <sub>2</sub>	x <sub>1</sub>	x <sub>5</sub>
52						53						54					

55, 56, 57

Lp	x <sub>3</sub>	x <sub>5</sub>	x <sub>1</sub>	x <sub>2</sub>	x <sub>4</sub>	Lp	x <sub>3</sub>	x <sub>5</sub>	x <sub>1</sub>	x <sub>4</sub>	x <sub>2</sub>	Lp	x <sub>3</sub>	x <sub>5</sub>	x <sub>2</sub>	x <sub>1</sub>	x <sub>4</sub>
55						56						57					

58, 59, 60

Lp	x <sub>3</sub>	x <sub>5</sub>	x <sub>4</sub>	x <sub>1</sub>	x <sub>2</sub>	Lp	x <sub>3</sub>	x <sub>5</sub>	x <sub>2</sub>	x <sub>4</sub>	x <sub>1</sub>	Lp	x <sub>3</sub>	x <sub>5</sub>	x <sub>4</sub>	x <sub>2</sub>	x <sub>1</sub>
58						59						60					

61, 62, 63

Lp	x <sub>3</sub>	x <sub>1</sub>	x <sub>2</sub>	x <sub>4</sub>	x <sub>5</sub>	Lp	x <sub>3</sub>	x <sub>1</sub>	x <sub>2</sub>	x <sub>5</sub>	x <sub>4</sub>	Lp	x <sub>3</sub>	x <sub>1</sub>	x <sub>4</sub>	x <sub>2</sub>	x <sub>5</sub>
61						62						63					

64, 65, 66

Lp	x <sub>3</sub>	x <sub>1</sub>	x <sub>5</sub>	x <sub>2</sub>	x <sub>4</sub>	Lp	x <sub>3</sub>	x <sub>1</sub>	x <sub>4</sub>	x <sub>5</sub>	x <sub>2</sub>	Lp	x <sub>3</sub>	x <sub>1</sub>	x <sub>5</sub>	x <sub>4</sub>	x <sub>2</sub>
64						65						66					

67, 68, 69

Lp	x3	x2	x4	x5	x1	Lp	x3	x2	x4	x1	x5	Lp	x3	x2	x5	x4	x1
67						68						69					

70, 71, 72

Lp	x3	x2	x1	x4	x5	Lp	x3	x2	x5	x1	x4	Lp	x3	x2	x1	x5	x4
70						71						72					

73, 74, 75

Lp	x4	x5	x1	x2	x3	Lp	x4	x5	x1	x3	x2	Lp	x4	x5	x2	x1	x3
73						74						75					

76, 77, 78

Lp	x4	x5	x3	x1	x2	Lp	x4	x5	x2	x3	x1	Lp	x4	x5	x3	x2	x1
76						77						78					

79, 80, 81

Lp	x4	x1	x2	x3	x5	Lp	x4	x1	x2	x5	x3	Lp	x4	x1	x3	x2	x5
79						80						81					

Nr tab. 82, 83, 84

Lp	x4	x1	x5	x2	x3	Lp	x4	x1	x3	x5	x2	Lp	x4	x1	x5	x3	x2
82						83						84					

Nr tab. 85, 86, 87

Lp	x4	x2	x3	x5	x1	Lp	x4	x2	x3	x1	x5	Lp	x4	x2	x5	x3	x1
85						86						87					

Nr tab. 88, 89, 90

Lp	x4	x2	x1	x3	x5	Lp	x4	x2	x5	x1	x3	Lp	x4	x2	x1	x5	x3
88						89						90					

Nr tab. 91, 92, 93

Lp	x4	x3	x5	x1	x2	Lp	x4	x3	x5	x2	x1	Lp	x4	x3	x1	x5	x2
91						92						93					

Nr tab. 94, 95, 96

Lp	x4	x3	x2	x5	x1	Lp	x4	x3	x1	x2	x5	Lp	x4	x3	x2	x1	x5
94						95						96					

Nr tab. 97, 98, 99

Lp	x5	x1	x2	x3	x4	Lp	x5	x1	x2	x4	x3	Lp	x5	x1	x3	x2	x4
97						98						99					

Nr tab. 100, 101, 102

Lp	x5	x1	x4	x2	x3	Lp	x5	x1	x3	x4	x2	Lp	x5	x1	x4	x3	x2
100						101						102					

Nr tab. 103, 104, 105

Lp	x <sub>5</sub>	x <sub>2</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>1</sub>	Lp	x <sub>5</sub>	x <sub>2</sub>	x <sub>3</sub>	x <sub>1</sub>	x <sub>4</sub>	Lp	x <sub>5</sub>	x <sub>2</sub>	x <sub>4</sub>	x <sub>3</sub>	x <sub>1</sub>
103						104						105					

Nr tab. 106, 107, 108

Lp	x <sub>5</sub>	x <sub>2</sub>	x <sub>1</sub>	x <sub>3</sub>	x <sub>4</sub>	Lp	x <sub>5</sub>	x <sub>2</sub>	x <sub>4</sub>	x <sub>1</sub>	x <sub>3</sub>	Lp	x <sub>5</sub>	x <sub>2</sub>	x <sub>1</sub>	x <sub>4</sub>	x <sub>3</sub>
106						107						108					

Nr tab. 109, 110, 111

Lp	x <sub>5</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>1</sub>	x <sub>2</sub>	Lp	x <sub>5</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>2</sub>	x <sub>1</sub>	Lp	x <sub>5</sub>	x <sub>3</sub>	x <sub>1</sub>	x <sub>4</sub>	x <sub>2</sub>
109						110						111					

Nr tab. 112, 113, 114

Lp	x <sub>5</sub>	x <sub>3</sub>	x <sub>2</sub>	x <sub>4</sub>	x <sub>1</sub>	Lp	x <sub>5</sub>	x <sub>3</sub>	x <sub>1</sub>	x <sub>2</sub>	x <sub>4</sub>	Lp	x <sub>5</sub>	x <sub>3</sub>	x <sub>2</sub>	x <sub>1</sub>	x <sub>4</sub>
112						113						114					

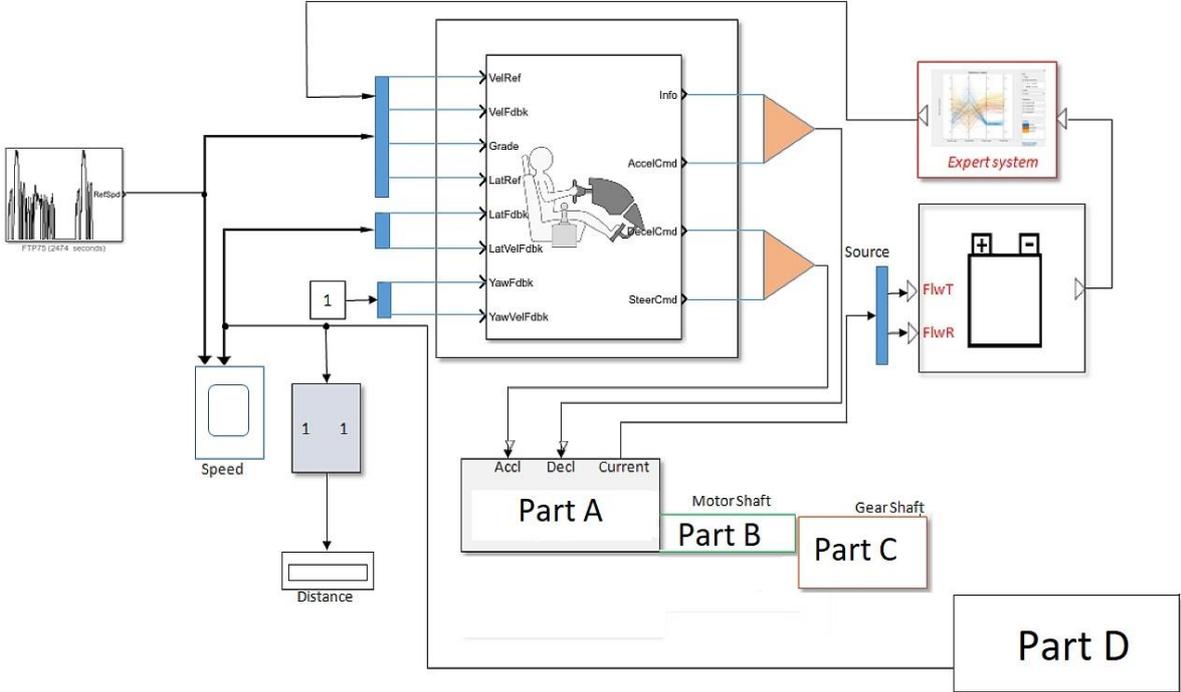
Nr tab. 115, 116, 117

Lp	x <sub>5</sub>	x <sub>4</sub>	x <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>	Lp	x <sub>5</sub>	x <sub>4</sub>	x <sub>1</sub>	x <sub>3</sub>	x <sub>2</sub>	Lp	x <sub>5</sub>	x <sub>4</sub>	x <sub>2</sub>	x <sub>1</sub>	x <sub>3</sub>
115						116						117					

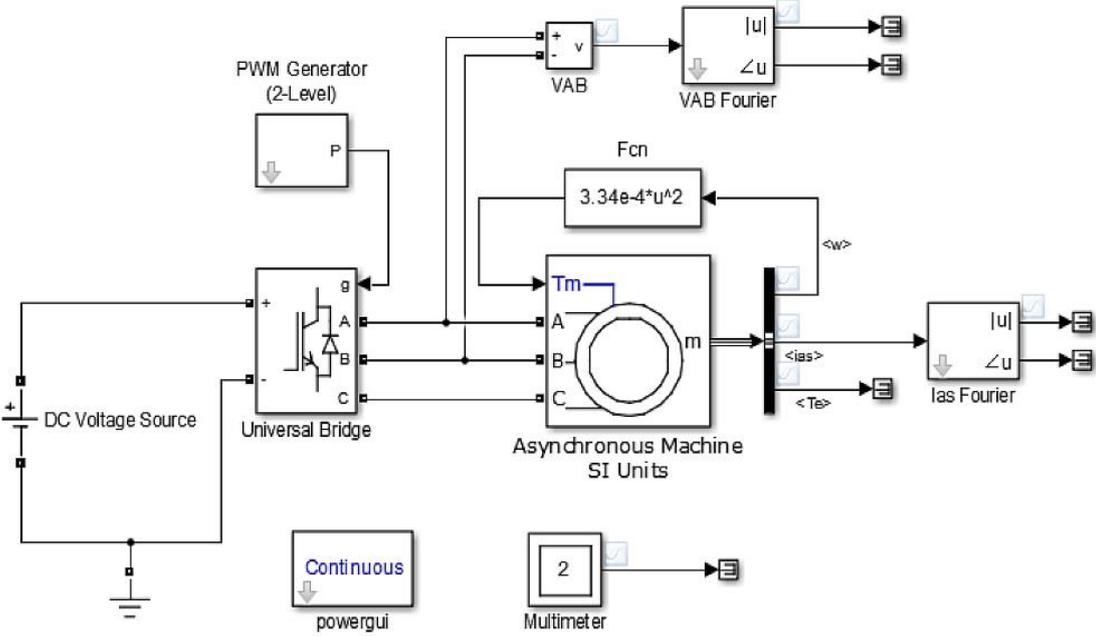
Nr tab. 118, 119, 120

Lp	x <sub>5</sub>	x <sub>4</sub>	x <sub>3</sub>	x <sub>1</sub>	x <sub>2</sub>	Lp	x <sub>5</sub>	x <sub>4</sub>	x <sub>2</sub>	x <sub>3</sub>	x <sub>1</sub>	Lp	x <sub>5</sub>	x <sub>4</sub>	x <sub>3</sub>	x <sub>2</sub>	x <sub>1</sub>
118						119						120					

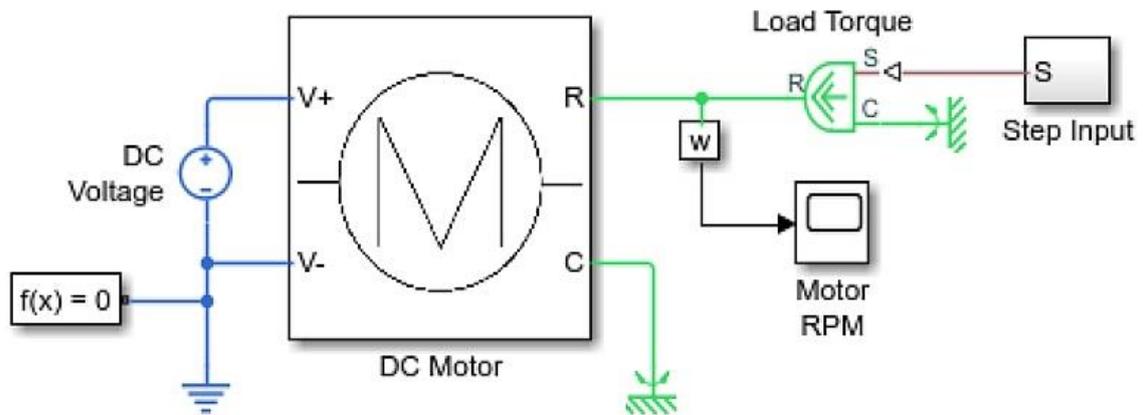
**Supplementary Materials S2. EV model in Matlab including expert system - with detailed presentation of selected elements**



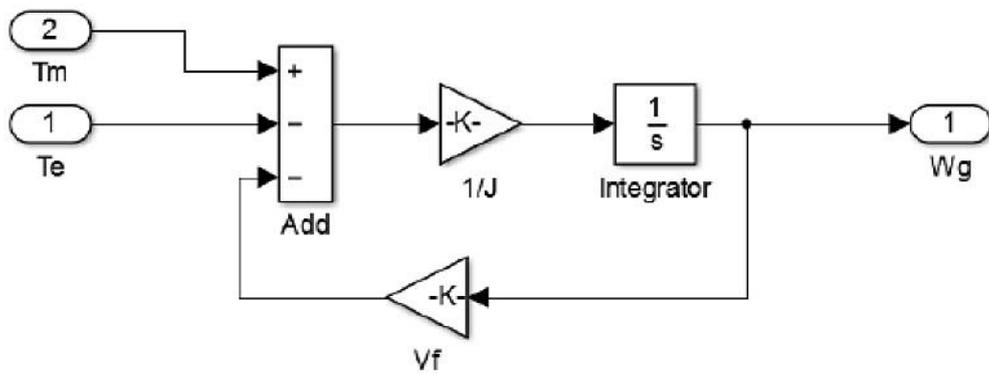
Proposed EV model in Matlab including expert system



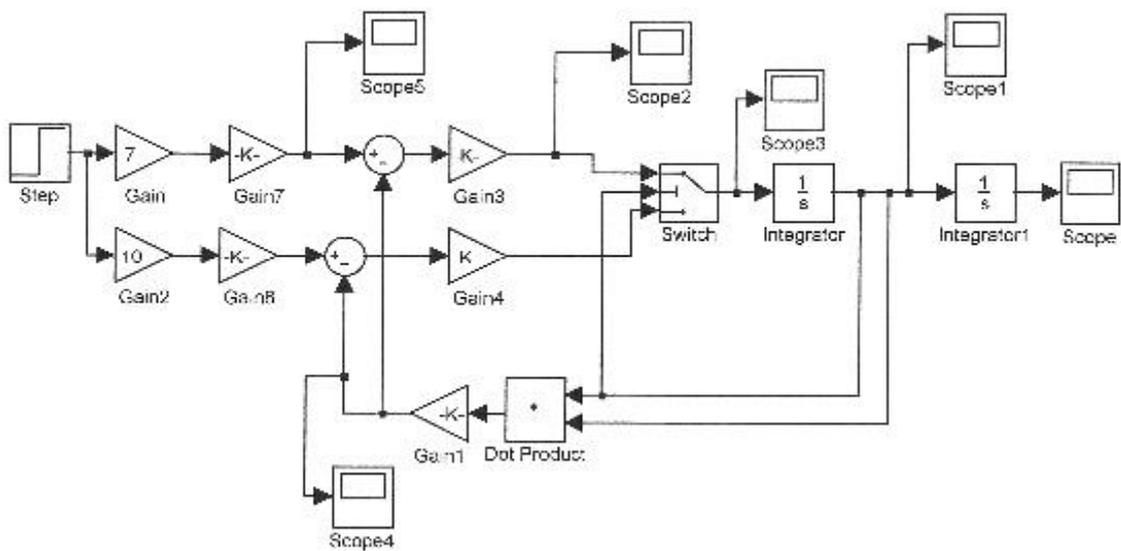
PART A. Energy control block for batteries



PART B. Gear unit shaft check block



PART C. Gear unit shaft check block



PART D. Speed control block