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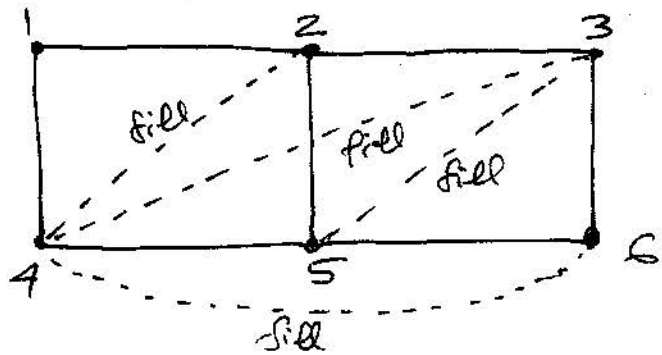
ECE 552
HW # 6
Solutions

Fall 2017

Y3

Prob. 6.1

(a) Given Order

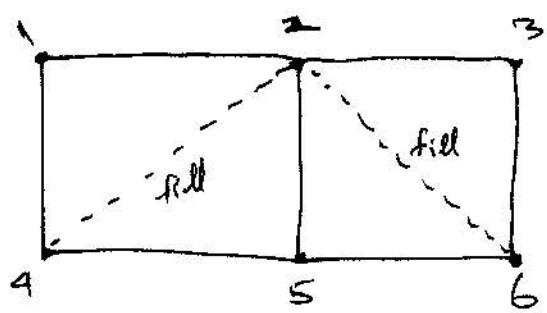


	1	2	3	4	5	6		LDL^T	(LD) Forward	(LT) Backward
1	X	X		X			X	5=2+(1+2)	3	2
2	X	X	X	F	X		F	9=3+(1+2+3)	4	3
3		X	X	F	F	X	X	9	4	3
4	X	F	F	X	X	F	F	5	3	2
5		X	F	X	X	X	F	2	2 1	1 0
6			X	F	X	X	F	30	17	11

(Only the lower part is stored and operated on) — col by col — row by row

Total: 30 + 17 + 11 = 58 operations

(b) Reordering ignoring current sources (using graphical method)



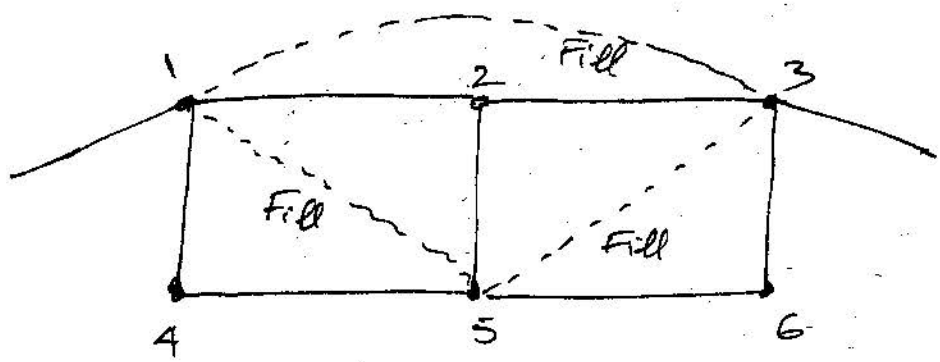
Reordered nodes: 1, 3, 4, 6, 2, 5

1	3	4	6	2	5
X		X		X	
	X		X	X	
X		X		F	X
	X		X	F	X
X	X	F	F	X	X
		X	X	X	X

LD	F	B
5	3	2
5	3	2
5	3	2
5	3	2
2	2	1
0	1	0
22	15	9

Total = 22 + 15 + 9 = 46 operations

(c) Include current sources (rhs) in reordering



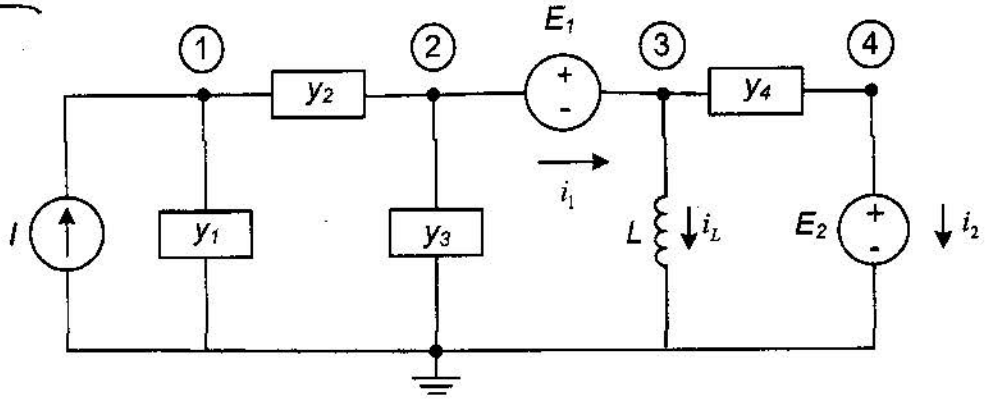
Order: 4, 6, 5, 2, 1, 3

	4	6	5	2	1	3	rhs	LD	F	B
4	X		X		X		0	5		2
6		X	X			X	0	5		2
5	X	X	X	X	F	F	0	9		3
2			X	X	X	X	0	5		2
1	X		F	X	X	F	X	2	1	1
3		X	F	X	F	X	X	—	—	—
								26	3	10

Total: 26 + 3 + 10 = 39 operations

In (c) the # of op. for LD factorization increased compared to (b), but the total decreased.

Prob. 6.2



(a)

	1	2	3	4	i_L	i_{E_1}	i_{E_2}				
1	y_1+y_2	$-y_2$	0	0					V_1		I
2	$-y_2$	y_2+y_3	0	0		1			V_2		
3	0	0	y_4	$-y_4$	1	-1			V_3		
4	0	0	$-y_4$	y_4			1		V_4		
									...	=	...
i_L			1		$-j\omega L$				i_L		
i_{E_1}		1	-1			0			i_1		E_1
i_{E_2}				1			0		i_2		E_2

Cannot factorize: Singular submatrix along diagonal.

(b)

	V_4	i_2	V_2	i_1	V_3	i_L	V_1				
El. Char	1								V_4		E_2
KCL	y_4	1			$-y_4$				i_2		0
El. Char.			1		-1				V_2		E_1
KCL			y_2+y_3	1	(F)		$-y_2$		i_1	=	0
El. Char.					1	$-j\omega L$			V_3		0
KCL	$-y_4$			-1	y_4	1	(F)		i_L		0
KCL			$-y_2$		(F)	(F)	y_2+y_3		V_1		I

Operations: 0 0 2 2 2 2 0 = 8 (No division by diagonal)

0 0 (3) (4) (3) (2) 0 = 12 (division by diag. 1)

(c) Can Choose $V_4, V_2, V_3, i_2, i_1, i_L, V_1$