

1. SDATA1: Reads and writes the structural data
2. STIFF1: Constructs the stiffness matrix
3. LDATA1: Reads and writes the load data
4. LOADS1: Constructs the load vector
5. RESUL1: Calculates and writes the results

Statements in these five subprograms are given in Sections 1.1 through 1.5 of the flow chart.

**Example 1.** The continuous beam structure analyzed in Sec. 4.9 (see Fig. 4-13a) is presented as the first example to demonstrate the computer program. For this purpose the following numerical values (in US units) are assumed:

$$E = 10,000 \text{ ksi} \quad L = 100 \text{ in.} \quad I_z = 1000 \text{ in.}^4 \quad P = 10 \text{ kips}$$

The input data required by the computer program are summarized in Table 5-9,

**Table 5-9**  
Data for Continuous Beam Example 1

Type of Data		Numerical Values					
Control Data		1	1	1			
Structural Data	(a)	3	5	3	10000.0		
	(b)	1	100.0		1000.0		
		2	100.0		2000.0		
		3	200.0		2000.0		
	(c)	1	1	1			
		3	1	0			
		4	1	1			
Load Data	(a)	2	3				
	(b)	2	−10.0	1000.0			
		3	−10.0	0.0			
	(c)	1	10.0	250.0	10.0	−250.0	
		2	10.0	250.0	10.0	−250.0	
		3	10.0	333.333	10.0	−333.333	

which conforms to the specifications for continuous beams given previously (see Table 5-3). Results from the computer program for this data are listed in Table 5-10.

**Example 2.** The continuous beam in Fig. 5-3a has constant flexural rigidity and is to be analyzed for the given loads in three stages, as follows: (1) concentrated loads, (2) distributed loads, and (3) total loads. Numerical values (in SI units) for this problem are

$$\begin{array}{llll}
 E = 200 \times 10^6 \text{ kN/m}^2 & L_1 = 6 \text{ m} & L_2 = 5 \text{ m} & I_z = 3.6 \times 10^{-3} \text{ m}^4 \\
 P = 50 \text{ kN} & w = 30 \text{ kN/m} & & M = 150 \text{ kN-m}
 \end{array}$$

Figure 5-3b shows the numbering system for the restrained structure. Input data for this example are given in Table 5-11; and the results appear in Table 5-12.

**Table 5-10**  
**Results for Continuous Beam Example 1**

STRUCTURE NO. 1 CONTINUOUS BEAM					
NUMBER OF LOADING SYSTEMS = 1					
STRUCTURAL PARAMETERS					
M	N	NJ	NR	NRJ	E
3	3	4	5	3	10000.0
MEMBER INFORMATION					
MEMBER	EL		ZI		
1	100.000		1000.00000		
2	100.000		2000.00000		
3	200.000		2000.00000		
JOINT RESTRAINTS					
JOINT	JR1	JR2			
1	1	1			
3	1	0			
4	1	1			
LOADING NO. 1					
NLJ		NLM			
2		3			
ACTIONS AT JOINTS					
JOINT	AJ1		AJ2		
2	-10.000		1000.000		
3	-10.000		.000		
ACTIONS AT ENDS OF RESTRAINED MEMBERS DUE TO LOADS					
MEMBER	AML1	AML2	AML3	AML4	
1	10.000	250.000	10.000	-250.000	
2	10.000	250.000	10.000	-250.000	
3	10.000	333.333	10.000	-333.333	
JOINT DISPLACEMENTS					
JOINT	DJ1		DJ2		
1	.00000E+00		.00000E+00		
2	-.13161E+00		.12103E-02		
3	.00000E+00		.84325E-03		
4	.00000E+00		.00000E+00		
MEMBER END-ACTIONS					
MEMBER	AM1	AM2	AM3	AM4	
1	33.056	1281.746	-13.056	1023.809	
2	3.056	-23.810	16.944	-670.635	
3	12.530	670.635	7.470	-164.682	
SUPPORT REACTIONS					
JOINT	AR1		AR2		
1	33.056		1281.746		
3	39.474		.000		
4	7.470		-164.682		

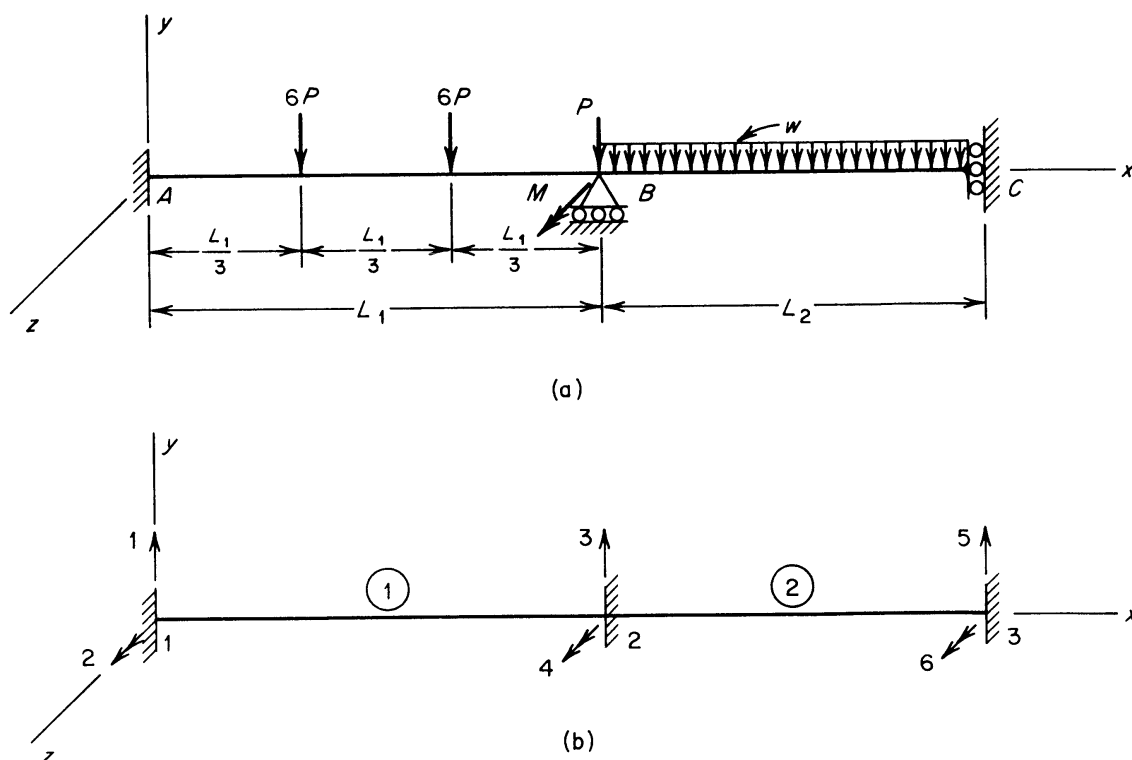


Fig. 5-3. Continuous beam Example 2.

**Table 5-11**  
Data for Continuous Beam Example 2

Type of Data			Numerical Values					
Control Data			2	1	3			
Structural Data		(a)	2	4	3	200000000.0		
		(b)	1	6.00	0.0036			
			2	5.00	0.0036			
		(c)	1	1	1			
			2	1	0			
			3	0	1			
Load Data Sets	1	(a)	1	1				
		(b)	2	− 50.0	150.0			
		(c)	1	300.0	400.0	300.0	− 400.0	
	2	(a)	0	1				
		(c)	2	75.0	62.5	75.0	− 62.5	
	3	(a)	1	2				
		(b)	2	− 50.0	150.0			
		(c)	1	300.0	400.0	300.0	− 400.0	
			2	75.0	62.5	75.0	− 62.5	

**Table 5-12**  
**Results for Continuous Beam Example 2**

STRUCTURE NO. 2 CONTINUOUS BEAM  
 NUMBER OF LOADING SYSTEMS = 3

STRUCTURAL PARAMETERS

M	N	NJ	NR	NRJ	E
2	2	3	4	3	200000000.0

MEMBER INFORMATION

MEMBER	EL	ZI
1	6.000	.00360
2	5.000	.00360

JOINT RESTRAINTS

JOINT	JR1	JR2
1	1	1
2	1	0
3	0	1

LOADING NO. 1

NLJ	NLM
1	1

ACTIONS AT JOINTS

JOINT	AJ1	AJ2
2	-50.000	150.000

ACTIONS AT ENDS OF RESTRAINED MEMBERS DUE TO LOADS

MEMBER	AML1	AML2	AML3	AML4
1	300.000	400.000	300.000	-400.000

JOINT DISPLACEMENTS

JOINT	DJ1	DJ2
1	.00000E+00	.00000E+00
2	.00000E+00	.88141E-03
3	.22035E-02	.00000E+00

MEMBER END-ACTIONS

MEMBER	AM1	AM2	AM3	AM4
1	405.769	611.538	194.231	23.077
2	.000	126.923	.000	-126.923

SUPPORT REACTIONS

JOINT	AR1	AR2
1	405.769	611.538
2	244.231	.000
3	.000	-126.923

LOADING NO. 2

NLJ	NLM
0	1

ACTIONS AT ENDS OF RESTRAINED MEMBERS DUE TO LOADS

MEMBER	AML1	AML2	AML3	AML4
2	75.000	62.500	75.000	-62.500

JOINT DISPLACEMENTS

JOINT	DJ1	DJ2
1	.00000E+00	.00000E+00
2	.00000E+00	-.40064E-03
3	-.20867E-02	.00000E+00

MEMBER END-ACTIONS

MEMBER	AM1	AM2	AM3	AM4
1	-48.077	-96.154	48.077	-192.308
2	150.000	192.308	.000	182.692

SUPPORT REACTIONS

JOINT	AR1	AR2
1	-48.077	-96.154
2	198.077	.000
3	.000	182.692

**Table 5-12**  
(Continued)

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LOADING NO. 3
  NLJ  NLN
    1    2

ACTIONS AT JOINTS
JOINT      AJ1      AJ2
  2      -50.000    150.000

ACTIONS AT ENDS OF RESTRAINED MEMBERS DUE TO LOADS
MEMBER      AML1      AML2      AML3      AML4
  1        300.000    400.000    300.000   -400.000
  2         75.000     62.500     75.000    -62.500

JOINT DISPLACEMENTS
JOINT      DJ1      DJ2
  1      .000000E+00 .000000E+00
  2      .000000E+00 .48077E-03
  3      .11685E-03 .000000E+00

MEMBER END-ACTIONS
MEMBER      AM1      AM2      AM3      AM4
  1        357.692    515.385    242.308   -169.231
  2        150.000    319.231      .000     55.769

SUPPORT REACTIONS
JOINT      AR1      AR2
  1        357.692    515.385
  2        442.308      .000
  3          .000     55.769

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