University *of* Dayton

AEE 546 — FEA 1

Department of Mathematics

Homework 2

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Problem 2.2-2

In each of the two plane structures shown, rigid blocks are connected by linear springs. Imagine that only horizontal displacements are allowed. In each case, write the structure equilibrium equations $[K]\{D\} = \{R\}$ in terms of spring stiffnesses k_i, displacement d.o.f. u_i, and applied loads F_i.

Problem 2.3-2

The plane structures shown consist of rigid weightless bars connected by linear springs, each of stiffness k. Degrees of freedom are horizontal translations u_i and small rotations θ_i for $i = 1, 2$, as shown. Vertical motion and out-of-plane displacements are not allowed. In each case determine the 4 by 4 structure stiffness matrix in terms of k and b.

Problem 2.5-2

The structure shown consists of a two-node element A, a three-node element B, and a four node element C. There is one d.o.f. per node. Place letters $A, B,$ and C in appropriate positions in arrays $[K]$ and $\{R\}$ to indicate the locations to which contributions from element matrices are assigned.

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Problem 2.7-2

(a) Let AE/L be the same for each bar of the plane truss in Fig. 2.5-2. Remove load P. Using the method of Eq. 2.7-6, impose the following displacements at node 1: $u_1 = c$ (where c is a small number), and $v_1 = 0$. Determine v_3 and the x and y components of load applied at node 1.

(b) Use the results of part (a) in Eq. 2.5-10 to determine support reactions at nodes 2 and 3.

(c) Show that the forces of parts (a) and (b) place the truss in static equilibrium.