ME 338
Manufacturing Processes II
HW#3

Instructor: Ramesh Singh
Assigned Date: Oct 15, 2018
Due Date: October 22, 2018

1. Consider the 2-D object shown in the figure below. (X, Y) represents the fixture coordinate system and (u, v) represents the object coordinate system.
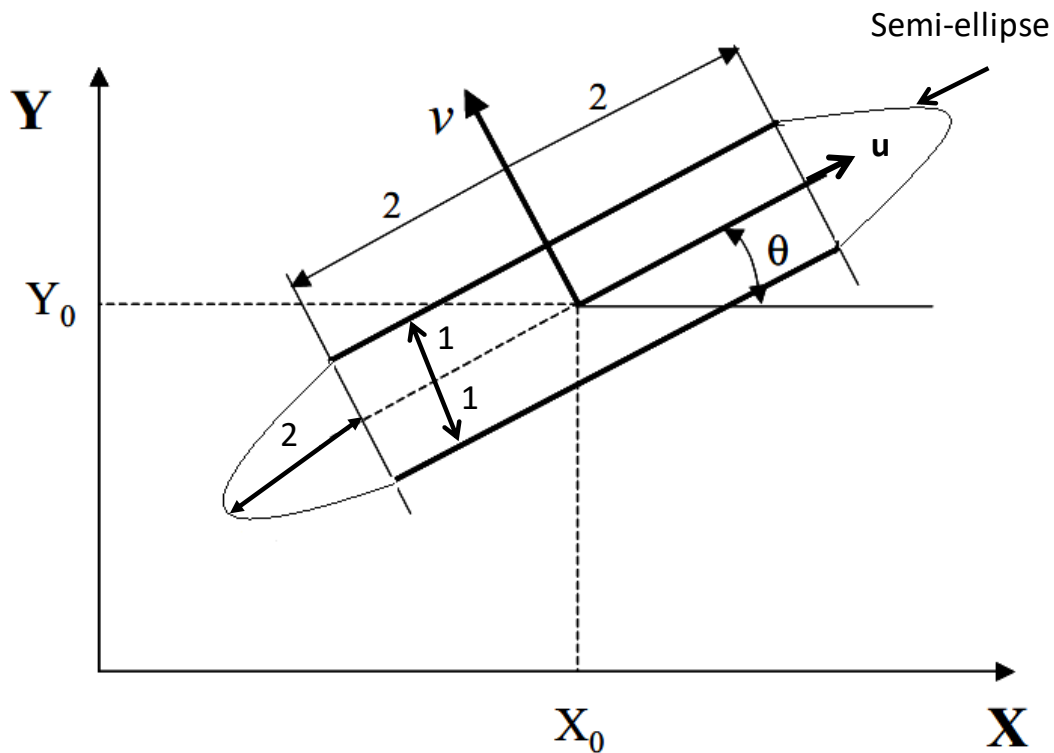

Figure 1. 2-D locator and clamping system

The 2-D object is to be clamped in a fixture with the following layout consisting of locators (denoted by L) and clamps (denoted by C):

L1: $(uL1, vL1) = (-1, -1)$
L2: $(uL2, vL2) = (1, -1)$
L3: $(uL3, vL3) = (-4, 0)$
C1: $(uC1, vC1) = (0, 1)$
C2: $(uC2, vC2) = (4, 0)$

In addition, $X0 = Y0 = 6$, and $\theta = 45°$

(a)   Prove that the fixture layout given above guarantees deterministic positioning.   Show all steps clearly.

(b) Determine if the fixture layout provides total constraint. Now repeat the process by taking the clamp C2 out and rework the problem to see if the deterministic positioning is still valid.

2. Show step-by-step which degrees of freedom could be prevented by each of 3, 2, 1 locators in. 3-2-1 fixturing system.

3. Explain which degrees of freedom are allowed for each type of contact (with and without friction) in Table 1 given below:

Table 1. Contact types and degrees of freedom allowed with and without friction

Contact Type	Friction	No Friction
Point	3	5
Line	1	4
Planar	0	3

4. Derive the expression for critical limit chip width beyond which chatter will occur in terms of cutting coefficient K, stiffness, k and damping ratio, ζ. Assume the system to be a single degree of freedom mass-spring damper.