Prince of Songkla University

Faculty of Engineering

Mid Term Examination, Semester 1 Academic Year 2007

Date : 28 July 2007 Time : 13:30-16:30

Subject : 215-625 System Modeling and Simulation Venue : R201

Note: 1. The paper comprised of 6 problems.

2. Any kind of calculators and documents are allowed.

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July 25, 2007

1. Give your point of view for computer modeling and simulation compare to physical modeling.

(20 points)

2. Describe the Steps in Modeling and Representing Dynamic Systems starting from the actual system to the performance analysis at the end.

(30 points)

3. Describe techniques (or computer languages) used in model implementation (or source code implementation).

(20 points)

4. Why simulation by digital computation is favored over the use of analytic solutions?

(20 points)

5. How would the integration algorithms and step size be important?

(20 points)

6. The pilot ejection system is given below. Write a model source code in Berkeley Madonna from the given mathematic model.

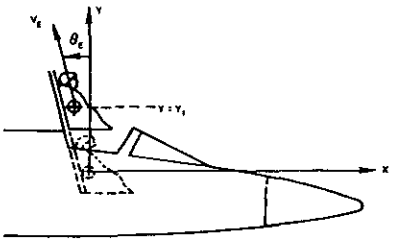

Figure A4-1. First Phase of Ejection

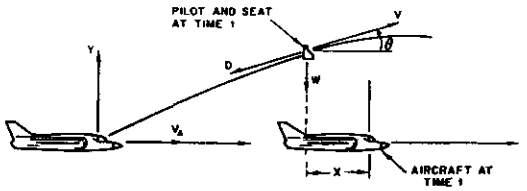

Figure A4-2. Space Trajectories of Vehicle and Pilot

System equations:

$$\begin{aligned}
\dot{x} &= V\cos\theta - V_A \\
\dot{y} &= V\sin\theta \\
\dot{V} &= 0 && ;\ 0 \le y < y_1 \\
\dot{V} &= -D/m - g\sin\theta && ;\ y \ge y_1 \\
\dot{\theta} &= 0 && ;\ 0 \le y < y_1 \\
\dot{\theta} &= -(g\cos\theta)/V && ;\ y \ge y_1 \\
D &= \rho C_D s V^2/2
\end{aligned}$$

Initial conditions:

$$V(0) = \sqrt{(V_Z - V_E\sin\theta_E)^2 + (V_E\cos\theta_E)^2}$$

$$\theta(0) = \tan^{-1}\frac{V_E\cos\theta_E}{V_A - V_E\sin\theta_E}$$

Given parameters:

$$\begin{aligned}
m &= 7 \text{ slugs} \\
g &= 32.2 \text{ ft/s}^2 \\
C_D &= 1 \\
s &= 10 \text{ ft}^2 \\
y_1 &= 4 \text{ ft} \\
\theta_E &= 15 \text{ deg } (15/57.3 \text{ rad}) \\
V_E &= 40 \text{ ft/sec} \\
V_A &= 900 \text{ ft/sec}
\end{aligned}$$

(30 points)