24-681 COMPUTER-AIDED DESIGN Spring 16

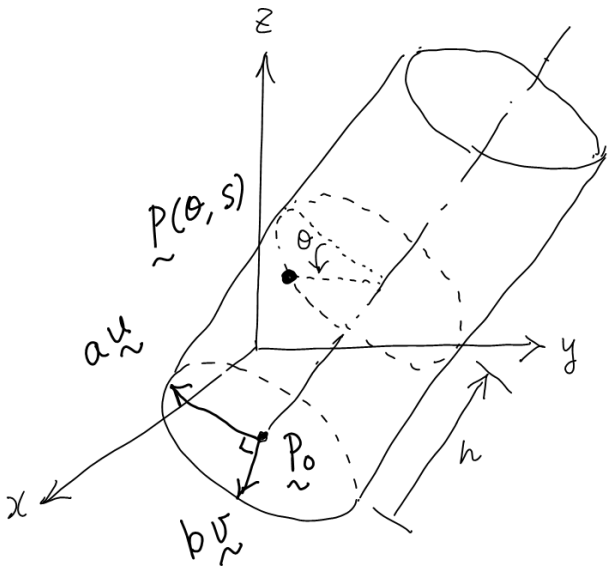
Carnegie Mellon University

PROBLEM SET 9

Due: **3/24/2016 (Thu) 3:00PM @ DH A302**
Issued: 3/15/2016 (Tue)
Weight: 3% of total grade
Note: * **Attach the last page of the problem set as the cover page of your paper.**

PS9-1 Parametric form of elliptic cylinder

Given two principal diameters, *a* and *b*, and vectors, **u**, **v** and $\mathbf{p}_0$, how is the elliptic cylinder shown in the figure below represented in the parametric form? Use the two parameters, θ and h as shown in the figure.

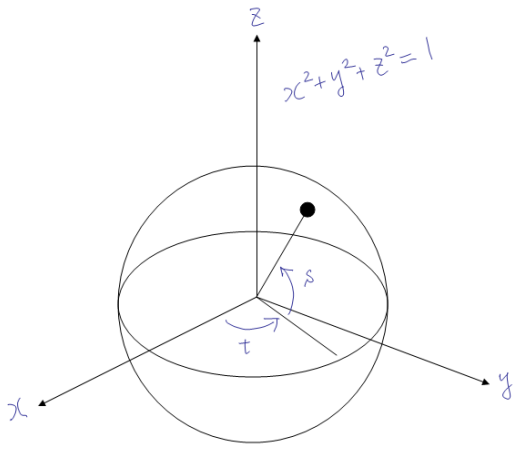


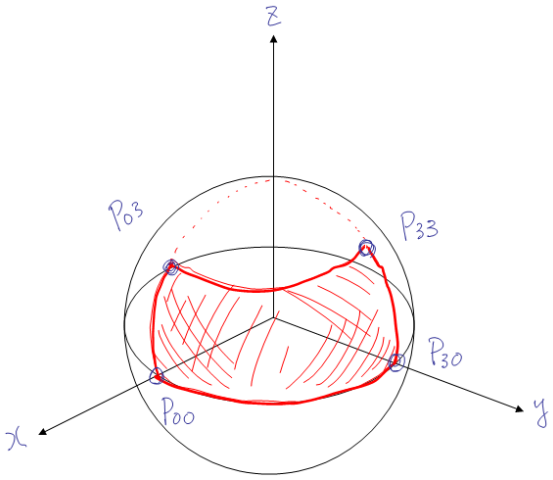
PS9-2 Approximating a spherical surface with a bi-cubic parametric surface

(1) What is the parametric form of the unit sphere shown in the left figure? Use parameters t and s, and make the parameter ranges of t and s

-1 < t < 1 and -1 < s < 1

respectively.





(2) Suppose you need to approximate the piece of the spherical surface shown in the right figure by a bi-cubic Hermite surface, find all the 16 geometry vectors. Assume that four twists are zeros. Note: the four corner control points are given by (t, s) = (0, 0), (0.5, 0), (0, 0.5), and (0.5, 0.5).

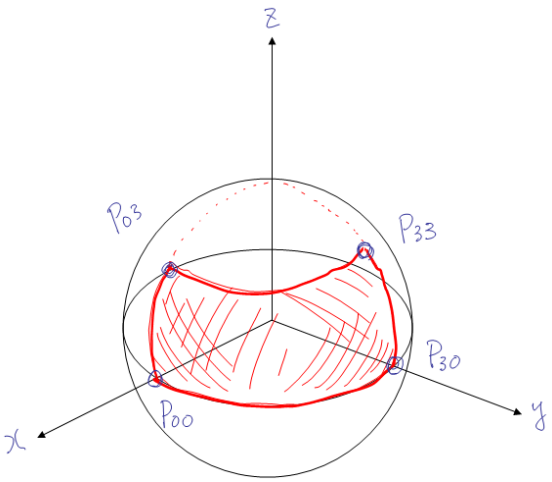
(3) Suppose you need to approximate the piece of the spherical surface shown in the right figure by a bi-cubic Bezier surface, find all the 16 Bezier control points. Note: the four corner control points are given by (t, s) = (0, 0), (0.5, 0), (0, 0.5), and (0.5, 0.5).

The following problem is optional: you will receive the full points, 100, by completing PS9-1 and PS9-2 correctly.

Bonus (10 pts)

Rendering a Bezier surface

Write a program that draws a Bezier surface. Using the 16 control points that you found in PS9-2 (3), render a Bezier surface along with the coordinate axes with VRML.



Your program should take 16 Bezier control points as input and generate a VRML file, bezier_surface.wrl, that renders the Bezier surface along with the coordinate axes.

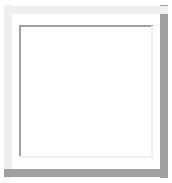
In your hand-in directory on AFS, make a new directory called ps9 (in lower case), and hand in:

- source codes, and
- bezier_surface.wrl
- "readme" file that explains on which platform and compiler you ran your code.

Also hand in a printout of:

- source codes, and
- pictures of bezier_surface.wrl (but do NOT submit the printout of the content of bezier_surface.wrl)

PS9



The first letter of your LAST name _____ First Name _____ Last Name

How many hours did you spend to complete this problem set?

_____ Hour(s)

How many no-penalty late days do you want to use for this problem set?

_____ Day(s)

24-681 COMPUTER-AIDED DESIGN Spring 16

Carnegie Mellon University

PROBLEM SET 9

Due: **3/24/2016 (Thu) 3:00PM @ DH A302**
Issued: 3/15/2016 (Tue)
Weight: 3% of total grade
Note: * **Attach the last page of the problem set as the cover page of your paper.**