

Course outline

How does an NPTEL online course work?

Prerequisite Assignment

Week 1

Week 2

Week 3

Week 4

Week 5

Week 6

Week 7

Week 8

Week 9

Week 10

Week 11

Introduction to Nanomechanics - Part 01

Introduction to Nanomechanics - Part 02

Introduction to Nanomechanics - Part 03

Introduction to Nanomechanics - Part 04

Introduction to Nanomechanics - Part 05

Introduction to Nanomechanics - Part 06

Quiz : Assignment 11

Variational Calculus and its applications in Control Theory and Nanomechanics : Week 11 Feedback Form

Week 12

Download Videos

Text Transcripts

Live Session

Assignment 11

The due date for submitting this assignment has passed.

Due on 2021-04-07, 23:59 IST.

As per our records you have not submitted this assignment.

1) A spheroidal surface P is given parametrically by the position vector $r(\theta, \phi)$ as

1 point

$$r(\theta, \phi) = (b \cos \theta \sin \phi, b \sin \theta \sin \phi, c \cos \phi)$$

where $-\pi < \theta \leq \pi$, and $0 \leq \phi \leq \pi$ and the constant b is the minor semi-axis length and c is the major semi-axis length. Which of the following expresses the scalar surface element dA for P ?

where $\epsilon^2 = 1 - \frac{c^2}{b^2}$

$dA = b^2 \sin \phi (1 + \epsilon^2 \sin^2 \phi)^{\frac{1}{2}} d\theta d\phi$

$dA = b^2 \sin \phi (1 - \epsilon^2 \sin^2 \phi)^{\frac{1}{2}} d\theta d\phi$

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$dA = b^2 \sin \phi (1 + \epsilon^2 \sin^2 \phi)^{\frac{1}{2}} d\theta d\phi$

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$dA = b^2 \sin^2 \phi (1 + \epsilon^2 \sin^2 \phi)^{\frac{1}{2}} d\theta d\phi$

No, the answer is incorrect. Score: 0

Accepted Answers:

$dA = b^2 \sin \phi (1 - \epsilon^2 \sin^2 \phi)^{\frac{1}{2}} d\theta d\phi$

2) Consider calculating the Lennard-Jones interaction energy E_s of a spherical surface S with radius a and atomic density η_s with some point a distance δ (assuming $\delta > a$) from the centre of the sphere, assuming the continuum approximation and Lennard-Jones constants of A and B. After adopting an appropriate parameterisation, which of the following is/are the integral form the interaction energy E_s

1 point

$E_s = \eta_s \int_0^\pi \int_{-\pi}^\pi (-A\rho^{-6} + B\rho^{-12}) a^2 \cos \phi d\theta d\phi$

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No, the answer is incorrect. Score: 0

Accepted Answers:

$E_s = \eta_s \int_0^\pi \int_{-\pi}^\pi (-A\rho^{-6} + B\rho^{-12}) a^2 \sin \phi d\theta d\phi$

3) By treating E_s from the question (2) above, as a hypergeometric integral, integrate the expression and express the result in terms of hypergeometric functions

1 point

$E_s = 2\pi a^2 \eta_s \left[-\frac{A}{(\delta - a)^6} F\left(3, 1; 2; -\frac{4a\delta}{(\delta - a)^2}\right) + \frac{B}{(\delta - a)^{12}} F\left(6, 1; 2; -\frac{4a\delta}{(\delta - a)^2}\right) \right]$

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No, the answer is incorrect. Score: 0

Accepted Answers:

$E_s = 2\pi a^2 \eta_s \left[-\frac{A}{(\delta - a)^6} F\left(3, 1; 2; -\frac{4a\delta}{(\delta - a)^2}\right) + \frac{B}{(\delta - a)^{12}} F\left(6, 1; 2; -\frac{4a\delta}{(\delta - a)^2}\right) \right]$