Háskóli Íslands
Verkfræðideild
Rafmagns- og tölvuverkfræði

Haust 2001

08.33.40 Hlutjónað rafgas

Dæmablað 6

Skilafrestur 17. október 2001 kl. 14:00

1. (15) Dæmi 6.5 í Lieberman og Lichtenberg
2. (15) Dæmi 7.5 í Lieberman og Lichtenberg
3. **Langmuir probe**

   (15) A cylindrical Langmuir probe with radius $a = 40\ \mu$m and length $d = 63$ mm is used to determine the plasma density n_{e} and electron temperature T_{e} in an argon discharge. The plasma potential (with respect to ground) is measured to be 30 V. The Langmuir probe I versus V_{B} characteristic is measured to be (V_{B} is the probe voltage with respect to ground).

I [μA]	-25	- 22	- 19.3	- 14.8	- 8.7	15	50.5	131	313	733
V_{B} [V]	-20	-10	0	10	15	20	22.5	25	27.5	30

   (a) According to (6.6.29), a plot of I^2 versus $\Phi_{\mathrm{P}} - V_{\mathrm{B}}$ should be a straight line in the ion saturation regime $\Phi_{\mathrm{P}} - V_{\mathrm{B}} \gg T_{\mathrm{e}}$. Plot I^2 versus $\Phi_{\mathrm{P}} - V_{\mathrm{B}}$ on linear scales for $\Phi_{\mathrm{P}} - V_{\mathrm{B}} \gg T_{\mathrm{e}}$. Extrapolate the linear part of this curve to determine the ion saturation current I_{i} over the entire voltage range $0 < \Phi_{\mathrm{P}} - V_{\mathrm{B}} < 50$ V. Then apply (6.6.29) to I_{i} (where m in (6.6.29) is the ion mass) to determine n_{s}.

   (b) Subtract I_{i} from I to determine the electron current I_{e} and plot $\ln I_{\mathrm{e}}$ (log scale) versus $\Phi_{\mathrm{P}} - V_{\mathrm{B}}$ (linear scale). You should obtain a straight line as in (6.6.6). Find T_{e} and n_{s} from your data. Compare the n_{s} value you find in part (a), and comment briefly on any discrepancy.