some boundary value prolbems in rarefied gas dynamics

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This thesis deals with the solution of four problems in rarefied gas dynamics, the -moments method is used to solve all these problems. Our aim of solving these pro blems is to get the dependence of the flow of a gas onthe degree of rarefaction, and on the other non-dimentional parameters charactrizing the-electro magnetic forces. Many investigators have treated these problems with a reflectioncoefficient equal to unity.In this thesis, we shall deal with pipes and gases for which the reflection coefficient es 1, and is considered of arbitrary value (oS 815 1 , o e25 1). Problem one:The plane couette flow of a rarefied gas with heat transfer under constant magnetic field with complete energy accomodation coefficient (0= 1)is treated. It is found that:-i)The temperature increases with increasing the distance between the plates for constant degree of rarefactionW.ii)The density ”n” decreases as distance increases, for constant values of f3 (degree of rarefaction of the gas), and y (the parameter of magnetic field), and it inc-reases as y increases for constant (3 and the dis- tance from mid point..iii)The velocity Vx increases as the distance increases, for constant Y and constant P; and it decreases as I-ii-increases for constant S and constant distance y , (from midpoint).iv) The shear stress P xy changes from -1 at S = 0 to zero at 5 = co for constant y ; and it decreases as y increases for constant S; also Pxy decreases asincreases for constant 5 and y. Problem two:The plane couette flow of a rarefied gas with heat transfer under constant magnetic field with different reflection coefficients is treated. It is found that:-i)The density n decreases as y increases for constant S, et= e, = 0.8 and y=0.1; also it increases as y increases for constants, y, and arbitrary 8 ; it also decreases as S increases for constant y andarbitrary ei e2-ii)The density jump decreases as S increases for arbi-trary A, , e, and constant y ; and it decreases as y increases for constant 5, except at et , (92= 1 it is independent of y and et= e2 = 0.8.iii)The temperature T is constant for any values of y and ei 02 in the case a. 0, and the temperature jump increases as 5 increases for any e, , e2.iv)The velocity Vx increases as y increases for any et, e2, s = 1 and y = 0.1 ; and it decreases as y increa-ses for constant S and constant 19,1v)The slip velocity V(s) (f) decreases by increasingfor constant y= 0.1 and for any el, e2.vi)The shear stress Pxy decreases as y increases for constant ei, 82 and constant 13 = 1, y= 0.1; and it increases as y increases for constant y and anyel, e2.vii)The shear stress Pxy(1) as S increases for -constant el, 82 and for y=0.1,where 0 is the degree of rarefaction, y is the para meter of magnetic field, and ’81, 82 are the reflec-tion coefficients from the surface.Problem three:The cylindrical couette flow of a rarefied gas with different reflection coefficient is treated . It is found that:-i)The velocity V8 increases as r increases for S = 0,S=c°-band q =--cx =f, q indicate the distance between the two cylinders.ii)The slip velocity Vs(q) increases as 5 (degree of1rarefaction) increases for q = -f .iii)The shear stress Pre increases as r increases for15 = 0 and q = f ; and Pre(q) increases as S increasesexcept for the case el = 0.5, 92=0.iv)The shear stress Pre(q) decreases by increasing q = (as the distance between the cylinders decreases).S-iv- Problem four:The cylinderical couette flow of a rarefied gas under constant magnetic field with different reflection coeffic-ients , is investegated. It is found that:-i)The velocity Ve(r) increases as r increases for (= 0, S == and q = 1; and it increases by increasing y (The parameter of magnetic field) fore =ii)The slip velocity Vs(q) increases as S increases except for e2 = 0; it also decreases as S increases for con-1q = 2'iii)The slip velocity Vs(q) increases by increasing y (the parameter of magnetic field) for constant S and q= 1 and it decreases as the distance between the cylindersdecreases for constant S.iv)The shear stress Pre(r) -increases as r increases for S = 0 and q = 1 except for the case e2 = 0, it dec reases as r increases for constant Y.v)The shear stress Pre(q) increases by increasing S for any e except for the case e2 = 0; it also decreases as S increases for constant Y 1 and q = .vi)The shear stress Pre(r) increases by increasingY for constant r and S= 0.vii)The shear stress Pre(q) increases by increasing Y for constant S; and it decreases as the distance between the cylinders decreases.stant y and.