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Numerical experiments on plasma focus pinch current limitation

S Lee[1,2,3], P Lee[2], S H Saw[3] and R S Rawat[2]

[1] Institute for Plasma Focus Studies, 32 Oakpark Drive, Chadstone, VIC 3148, Australia
[2] Nanyang Technology University, National Institute of Education, Singapore 637616, Singapore
[3] INTI International University College, 71800 Nilai, Malaysia

E-mail: leesing@optusnet.com.au

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Abstract
Contrary to the general expectation that performance of a plasma focus would progressively improve with progressive reduction of its static inductance L_o, a recent paper suggests that there is in fact an optimum L_o below which although the peak total current increases progressively the pinch current and consequently the neutron yield of that plasma focus would not increase, but instead decreases. This paper describes the numerical experiments and results that led to this conclusion.

1. Introduction

A recent paper [1] suggests that for any plasma focus with a fixed capacitance C_o, there is an optimum static inductance L_o, below which the focus pinch current I_{pinch} no longer increases. This paper describes the numerical experiments and results leading to this conclusion of a plasma focus pinch current limitation effect.

We need to say right at the beginning that this I_{pinch} limitation effect is not the same[4] as the I_{max}-related mechanism proposed by Nukulin and Polukhin [2] to explain an observed neutron saturation effect. In [2] it is postulated that in large plasma focus devices the peak total discharge current I_{peak} (which they denote as I_{max}) hardly increases with increase in storage energy through increase in bank capacitance C_o. This 'tardiness' of I_{peak} leads to an equation which in the limit of large storage energies E tends towards a constant neutron yield Y_n. We state here that [2] deals with a special, though important, class of plasma focus discharge conditions where an increase in C_o needs a corresponding increase in anode length z_o. This in turn leads to a situation where the effective discharge impedance, which determines I_{peak} for any given operating voltage V_o, seems to tend towards a constant value as E increases with C_o, thus limiting I_{peak}. This work delves deeper into the problem. We show that in another

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