

# MODELLING AND SIMULATION OF ELECTRO DISCHARGE MACHINE SYSTEMS

A. Yahya, and C. D. Manning

Department of Electronic and Electrical Engineering

## 1. INTRODUCTION

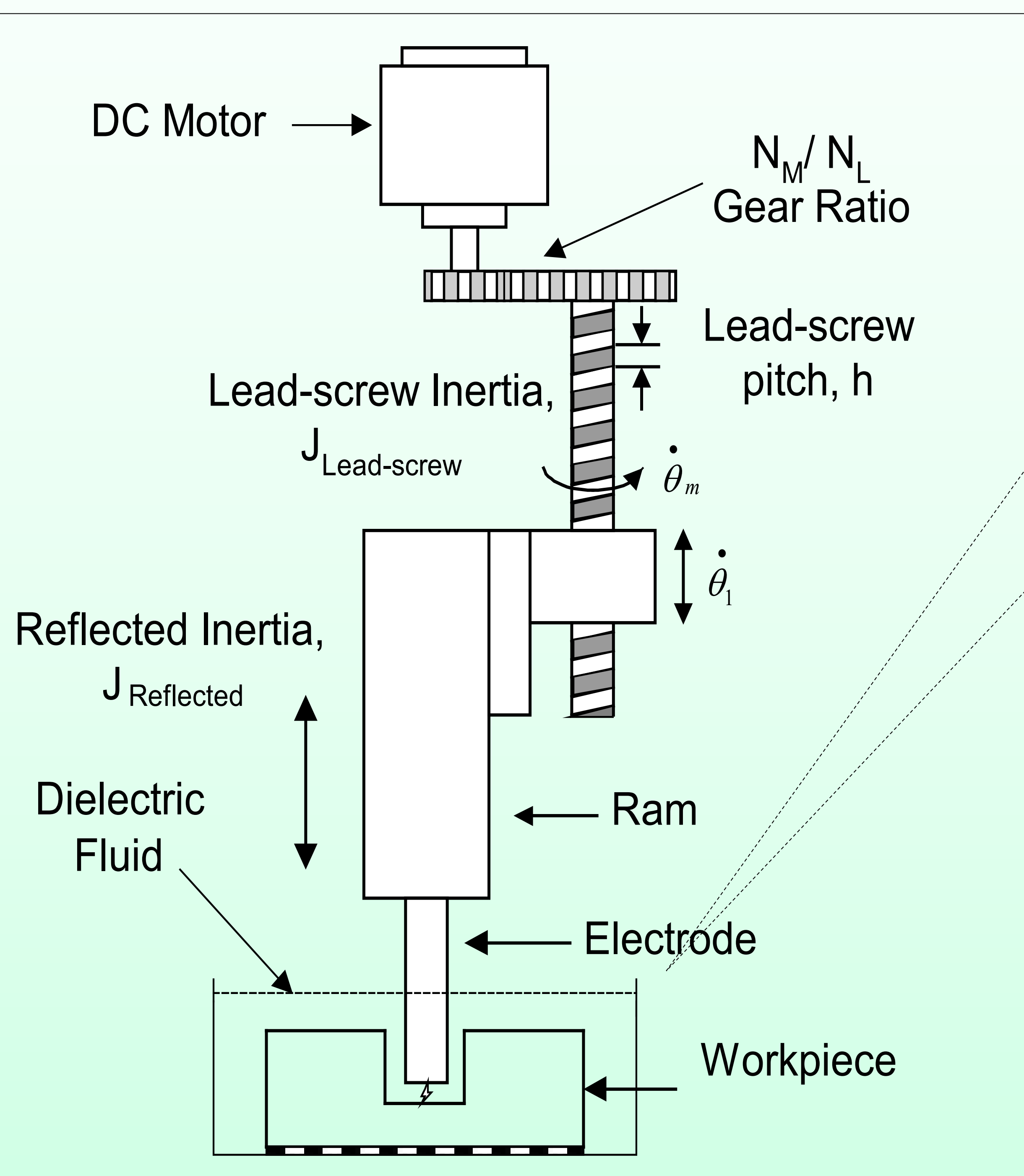


Fig. 1 Mechanical of EDM system

## 2. MODELLING EDM SYSTEM

EDM system consists of a servo system and the EDM process itself. The servo system incorporates two major subsystems; a servomotor and its controller and a lead-screw load containing the tool electrode.

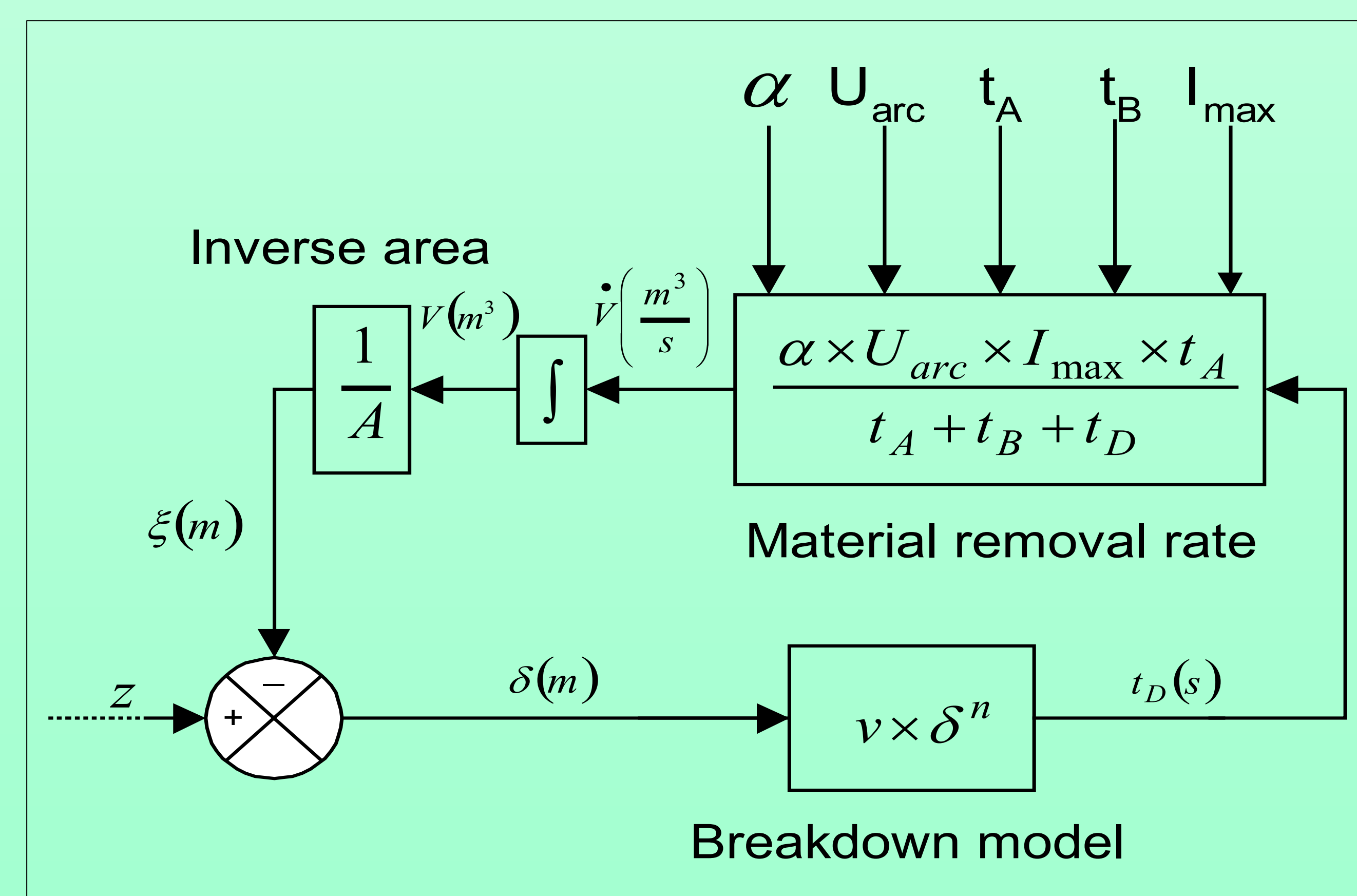
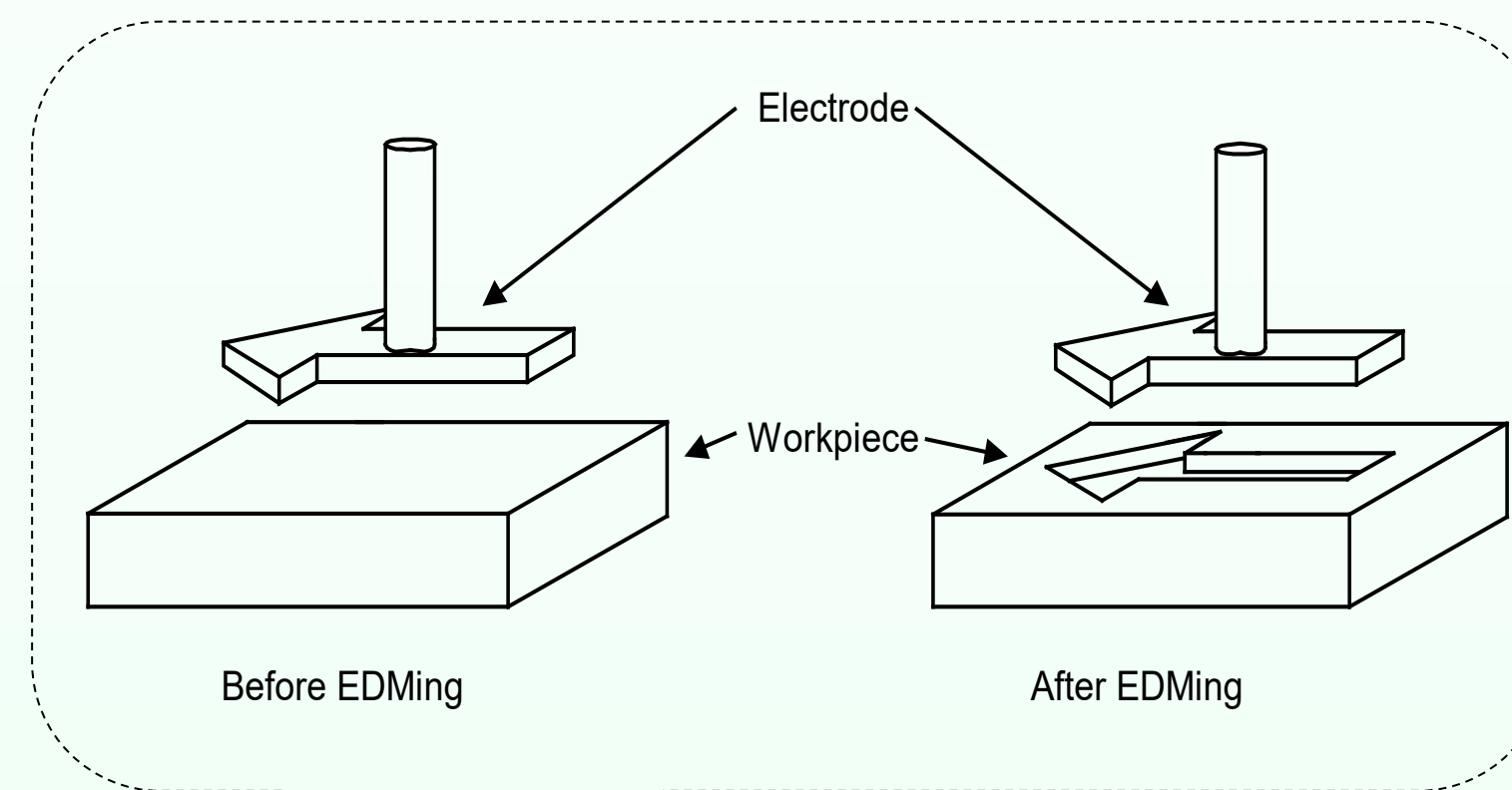


Fig. 2 Model of EDM process

A model of EDM process based on process parameters has been investigated by [1] and [4]. The model shown in Fig. 2 has established a relationship between the servodrive and the EDM process was used in a Matlab/Simulink simulation to ascertain the erosion rate in mm<sup>3</sup>/min.



In an Electrical Discharge Machine (EDM), metal is removed by applying a series of current electrical discharges through a small gap (approximately 10 to 100 microns) filled with dielectric fluid between an electrode and a workpiece.

Fig. 1 shows the EDM system and the workpiece before and after the EDM machining according to the electrode (arrow shape).

This article present a model of the EDM system for a Die-Sinking Electrical Discharge Machine (EDM) which accurately predicts the metal removal rate for copper electrode and steel workpiece. A new value for the material removal rate constant,  $\alpha$  has been identified to replace the previous value reported by [1].

## 3. RESULT AND DISCUSSION

A graph of the experimental copper-steel results is plotted in Fig. 4. It shows the erosion rate as a function of average gap power.

$$\left( I_{\max} * U_{\text{arc}} * \frac{t_A}{t_A + t_B + t_D} \right)$$

Fig. 4 also shows the predicted erosion rate results from the simulation.

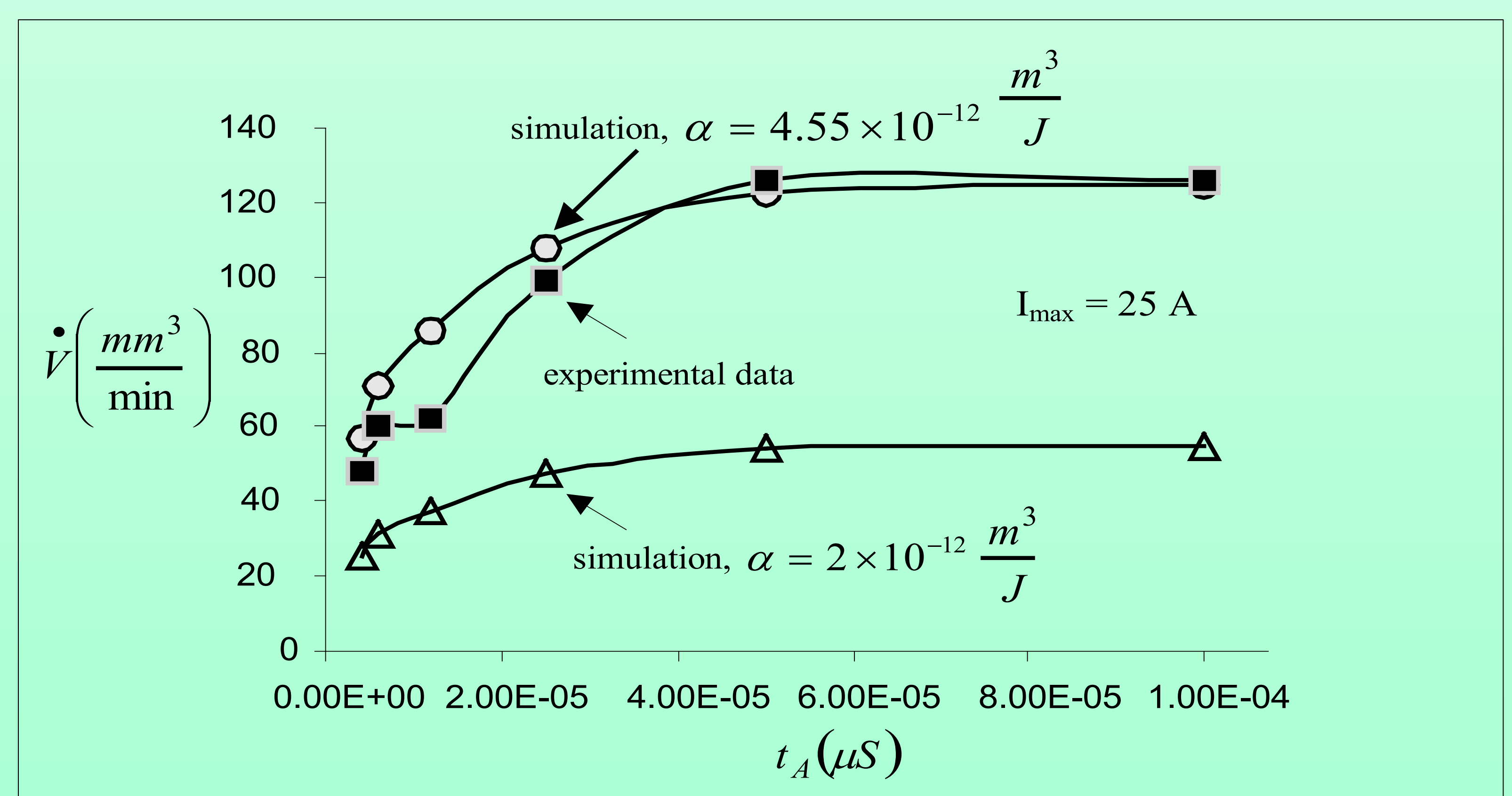


Fig. 4 Erosion rate as a function of on-time showing a comparison of simulation and experimental results.

## 4. CONCLUSION

An EDM system has been modelled and simulated to predict the erosion rate. The material removal rate constant,  $\alpha$  had to be substantially increased from the value suggested in reference [1] in order to achieve accurate prediction of erosion rate.

## 5. REFERENCES

- [1]Altpeter, F., and Tricarico, C., (2001), "Modeling for EDM gap control in die sinking", *13<sup>th</sup> International Symposium For Electromachining*, pp. 75-83.
- [2]Benjamin, C., Kuo., (1991), "Automatic Control Systems", Prentice-Hall, ISBN 0-13-051046-7