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Concurrency Control in Cad Using Artificial Neural Network and Fuzzy Logic

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ABSTRACT: This research work focuses on implementation of novel Concurrency Control methods using Artificial Neural Networks (ANN) and Fuzzy Logic with applications to Computer Aided Design / Computer Aided Manufacturing (CAD/CAM) database that involves more and unspecified duration of time to complete a transaction. Most of the transactions in the CAD/CAM data base include drawing entities to form a complete manufacturing drawing, with processing and inventory details. In this research work, Artificial Neural Network method using Functional Update Back Propagation Algorithm (FUBPA) and Locally Weighted Projection Regression (LWPR) and Fuzzy Logic have been used for implementing Concurrency Control while developing product Bearing using Autodesk inventor 9. This work ensures that associated parts cannot be accessed by more than one person due to locking. The ANN and Fuzzy Logic learn the objects and the type of transactions to be done. During testing performance, metrices are analyzed.

KEYWORDS: Concurrency Control, Functional Back Propagation *Network, Locally Weighted Projection Regression, Fuzzy Logic, Bearing, Tr*ansaction Locks, Time Stamping.

I. INTRODUCTION

Concurrency Control (CC) is an important concept for proper transactions on objects to avoid any loss of data or to ensure proper updation of data in the database. It is an important aspect in controlling and coordinating data reading and data modification especially in long time transaction database. In spite of sophisticated algorithms available for proper locking and unlocking of objects during transactions, intelligent methods with knowledge base information have been proposed and implemented.

In the absence of information about how and when the data items are accessed, Two Phase Locking (2PL) is both necessary and sufficient to ensure serializability by locking. In advanced applications, it is often the case that the database management system (DBMS) has prior knowledge about the order of access of data items. The DBMS can use this information to ensure serializability by using locking protocols that are not 2PL.

One of the problems of locking mechanisms is the potential for deadlock. Deadlock occurs when two or more transactions are mutually waiting for each other’s resources. This problem can be solved by assigning each transaction a unique number, called a timestamp, which increases monotonically [12]. The sequence is a function of the time of the day.

In this research work, Functional Update Back Propagation Algorithm [13], Locally Weighted Projection Regression and Fuzzy Logic have been implemented. All the algorithms are able to train the lock status and provide lock, as and when required by the transaction on objects. The perfomance of the algorithms have been compared based on the following criteria.

1. Locking time for each object
2. Releasing time for each object
3. Total Locking time for each transaction group
4. Total Releasing time for each transaction group.
5. Computation complexity.

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6. Memory space occupied.

II. PROBLEM DEFINITION

There is inability to provide consistency in the database when long transactions are involved. It will not be able to identify, if there is any violation of database consistency during the time of commitment. It is not possible to know, if the transaction is with undefined time limit [1, 17].

There is no serializability when many users work on shared objects. During long transactions, optimistic transactions and two phase locking will result in deadlock. Two phase locking forces to lock resources for long time even after they have finished using them. Other transactions that need to access the same resources are blocked [2, 18]. The problem in optimistic mechanism with Time Stamping is that, it causes repeated rollback of transactions when the rate of conflicts increases significantly [3].

A bearing-type connection is the most common type of product bearing. It is used in most simple-shear connections and in situations when loosening or fatigue due to vibration. A slip-critical connection is one in which loosening due to vibration or load reversals are to be considered. Product bearing is easily disassembled. They can be designed to take tension loads [10-11].

Inbuilt library functions for product bearing are available in Autodesk inventor 9. The product Bearing is shown in Figure 1 Drawing considered for implementation of the proposed algorithms is shown in Figure 1

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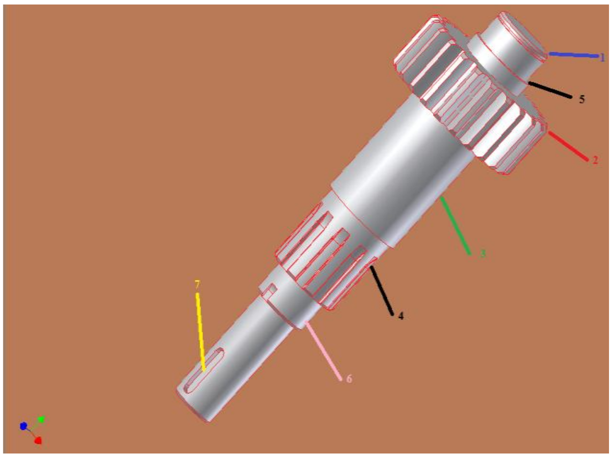

Fig.1 Bearing

The parts for Bearing is given in Table 1

Table 1 Bearing Parts	
Label No.	**Part name**
1	Top diameter
2	Gear teeth
3	Support shank
4	Slotted groove
5	Stepped diameter
6	Single slot step
7	Locking slot

In general, the following sequences are formed when creating Bearing. Even though library files are available for bearing drawing, customized drawing Bearing file is discussed [7]. The major parameters involved in creating the Bearing are wedge, thickness, hole and pin [15, 16]. The various constraints that have to be imposed during modifications of features by many transactions on this Bearing are as follows:

1. During diameter modification, chamfering has to be locked.

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2. During length or depth modification, diameter has to be locked.
This Bearing has two major entities.
1) Features 1, 5, 3, 6, 7 (set 1)
2) Features 2, 4 (set 2)
Set 1 and set 2 can be made into individual drawing part files (part file 1 and part file 2) and combined into one assembly file (containing the part files 1 and 2 are intact). When the transactions are accessing individual part files, then transactions in part file 1 need not worry about the type of transactions in part files 2 and vice versa [4]. When the part files 1 and 2 are combined into a single assembly file, then inconsistency in the shape and dimension of the set 1 and set 2, during matching should not occur. Provisions can be made in controlling the dimensions and shapes with upper and lower limits confirming to standards [5]. At any part of time when a subsequent of transaction is trying access locked features, it can modify the features on his system and store as an additional modified copy of the features with time stamping and version names (allotted by the transaction / allotted by the system).

Let us assume that there are two transactions editing the Bearing. Transaction 1 edits O_1 and hence O_2, O_3, O_4, O_6, will be locked sequentially (Table 2) [6]. Immediately, transaction 2 wants to edit O_2 orO_4 orO_7, however, it will not get transaction as already O_2 is locked. However, transaction 2 or any other transaction can try to access O_6.

Table 2 Bearing Shape and dimension consistency management

Group	First feature	Remaining feature to be locked
G1	1	2, 3, 4, 6
G2	2	3
G3	4	3, 6
G4	7	6

Initially, transaction 1 and transaction 2 have opened the same Bearing file from the common database. The following steps shows sequence of execution and results [8].

Step 1: T_1 edits O_1 with write mode. Table 3, shows pattern formed for the OL training.

Table 3 T_1 First time pattern used for training OL

Object number	Input pattern	Target output pattern
O_1	[1]	[0 1 0]

Step 2: The transaction manager locks objects mentioned in the third column of Table 2 Repeat step 1 with the patterns given in Table 4.

Table 4 T_1 Additional patterns used for training OL

Object number	Input pattern	Target output pattern
O_1	[1]	[0 1 0]
O_2	[3]	[0 1 0]

Step 3: A new transaction T_2 access O_7. A pattern is formed to verify if lock has been assigned to O_2 and its associated objects O_3. Only when the locks are not assigned to O_2 and O_3 then T_2 is allowed [12].

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The patterns of additional transactions are presented to the OL testing module to find if the output [0 0 0] is obtained in the output layer. During OL testing, the final weights obtained during OL training will be used [13]. Otherwise it means that lock has been assigned to either O_2. In such case, transaction is denied for T_2. Else the following Table 5 is presented in step 1.

Step 4: To know the type of lock value assigned to an object and for a transaction, OL testing is used. OL testing uses the final weights created by OL training.

Table 5 T_2 Additional patterns used for training OL		
Object number	**Input pattern**	**Target output pattern**
O_1	[1]	[0 1 0]
O_2	[2]	[0 1 0]
O3	[3]	[0 1 0]
O_4	[4]	[0 1 0]
O_6	[6]	[0 1 0]

III. RESULT COMPARISONS

A comparative performance of FUBPA / LWPR / FL for Bearing (Figure 2 - 5) is presented. FUBPA takes more locking time and FL takes least locking time. FUBPA takes more releasing time and FL takes least releasing time [14]. The comparison of the performances of FUBPA, LWPR and FL for locking and unlocking of transactions of objects in Bearing. The FL requires less time in granting locks and unlocking of transactions when compared to that of FUBPA and LWPR. Table 6 shows overall time consumed for one transaction object [9].

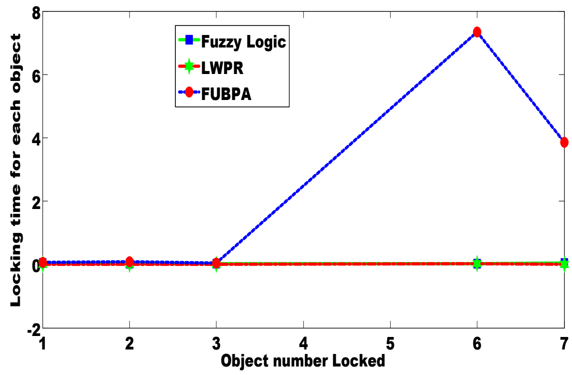

Fig. 2 Locking time for each object in Bearing using FUBPA/ LWPR/ FL

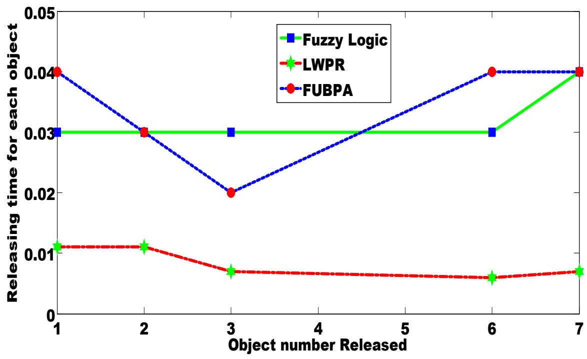

Fig. 3 Releasing time for each object in Bearing using FUBPA/ LWPR/ FL

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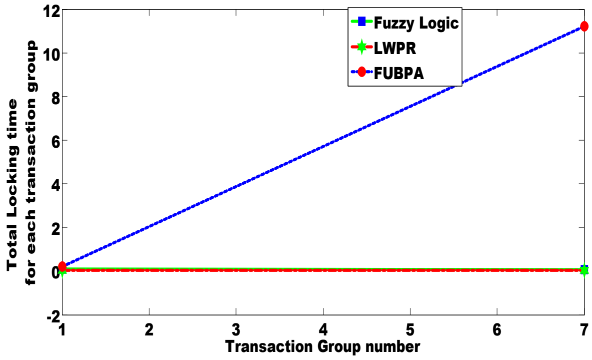

Fig. 4 Total Locking time for each transaction group in Bearing using FUBPA/ LWPR/ FL

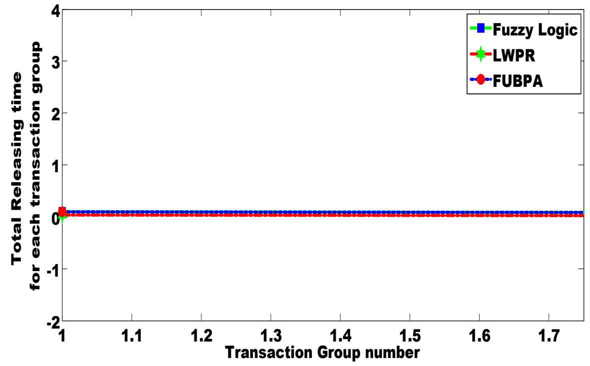

Fig. 5 Total Releasing time for each transaction group in Bearing using FUBPA/ LWPR/ FL

IV. CONCLUSIONS

This paper has implemented ANN algorithms and Fuzzy logic for concurrency control in CAD/CAM database. A different approach for minimizing the deadlock during long time transactions have been presented.

Table 6 Overall time consumed for one transaction object

Performance metric for concurrency control	FUBPA	Fuzzy Logic	LWPR
Locking time for each object	High	Low	Least
Releasing time for each object	High	Low	Least
Total locking time for each transaction group	High	Low	Least
Total releasing time for each transaction group	High	Low	Least
Reason for High / Low / Least	Training is based on convergence criteria	Training is based similarity between successive outputs	One time presentation of all the patterns
Chice of algorithm for implementation in concurrency control	Not preferred	Less preferred	Most preferred

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