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Implementation of Artificial Neural Network and Fuzzy Logic for Concurrency Control in CAD Data Base

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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, focus Artificial Neural Network method using Functional Update Back Propagation Algorithm (FUBPA) and Locally Weighted Projection Regression (LWPR) and Fuzzy Logic for implementing Concurrency Control while developing Dial of Fork using Autodesk inventor 9. While implementing concurrency control, this work ensures that associated parts cannot be accessed by more than one person due to locking.During testing performance, metrices are analyzed.

KEYWORDS: Concurrency Control, Functional Back Propagation *Network, Locally Weighted Projection Regression, Fuzzy Logic, Dial of Fork, T*ransaction 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 knowledgebase information have been proposed and implemented in this research work.

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 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. The sequence is a function of the time of the day.

In this research work, Functional Update Back Propagation Algorithm, 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 algorithm 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.

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5. Computation complexity.
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 [1]. It is not possible to know, if the transaction is with undefined time limit.

There is no serializability when many users work on shared objects [2]. 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 [4]. The problem in optimistic mechanism with Time Stamping is that it causes repeated rollback of transactions when the rate of conflicts increases significantly.

A bearing-type connection is the most common type of Dial of Fork [3]. 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. Dial of Fork is easily disassembled. They can be designed to take tension loads [5].

Inbuilt library drawing for the Dial of Fork are available in Autodesk inventor 9. The Dial of Fork is shown in Figure 1 Drawings considered for this research work are:

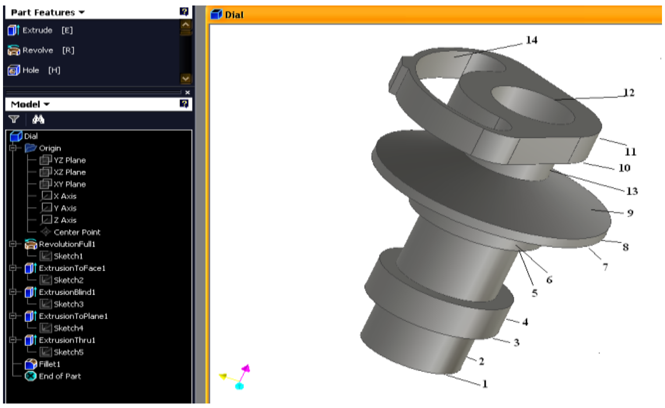

Fig.1 Dial of Fork

The parts for Dial of Fork is given in Table 1

Table 1 : Dial of Fork Parts

Label Number	Part name	Label Number	Part name
1	Lower end	**8**	Thickness of the wedge
2	Height of the end part	**9**	Slope of the wedge
3	External support	**10**	Wedge lock
4	Height of the external support	**11**	Height of the wedge lock
5	Support for the wedge	**12**	Concentric hole
6	Height of the wedge	**13**	Separator
7	Wedge	**14**	Guideway

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There are two transactions T_1 and T_2 involved in accessing and modifying the features [6]. Initially T_1 changes O_1 followed by modifications of dimension O_{10} by T_2. From Table 2, it can be noted that, when O_1 is accessed then O_2 have to be write locked [20]. By default, if any transaction access O_{10} then from Table 2, it can be noticed that O_{11} O_{12} O_{13} O_{14} have to be write locked. T_2 can access O_{10} O_5 O_3 as long as T_1 has not accessed [7].

Table 2: Fork Shape and dimension consistency management

Group	First feature	Remaining feature to be locked
G1	1	2
G2	10	11,12,13,14
G3	5	6,7,8,9
G4	3	4

To start with, transaction 1 and transaction 2 have opened the Fork files from the common database [8, 19]. The following steps shows sequence of execution and results

Step 1: T_1 access O_1 with write mode. Table 3 shows pattern used for the OL training.

Table 3 T_1First 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 2.3. Repeat step 1 with the additional 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 1]	[0 1 0]
O_2	[2 1]	[0 1 0]

Step 3: A new transaction T_2 access O_2. A pattern is formed to verify if lock has been assigned to O_2 and its associated objects O_1. Only when the locks are not assigned to O_2 and O_1 then T_2 is allowed [13-16].

The following input patterns are presented to the testing module to find if the output [0 0 0] is obtained in the output layer. During testing, the final weights obtained during training will be used [17,18]. 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 3.

Table 5 T_2 Additional patterns used for training OL

Object number	Input pattern	Target output pattern
O_1	[1 1]	[0 1 0]
O_2	[2 1]	[0 1 0]
O_3	[3 1]	[0 1 0]
O_4	[4 1]	[0 1 0]
O_5	[5 1]	[0 1 0]
O_6	[6 1]	[0 1 0]
O_7	[7 1]	[0 1 0]
O_8	[8 1]	[0 1 0]

Step 4: To know the type of lock value assigned to an object, OL testing is used. OL testing uses the final weights created by OL training [9-12].

III. RESULT COMPARISONS

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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. 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

FORK DRAWING

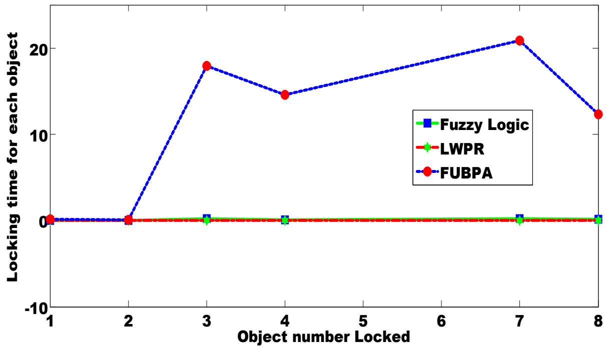

Fig. 2 Locking time for each object in Fork using FUBPA/LWPR/FL

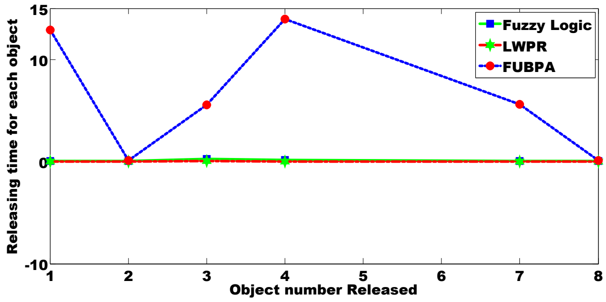

Fig. 3 Releasing time for each object in Fork using FUBPA/LWPR/FL

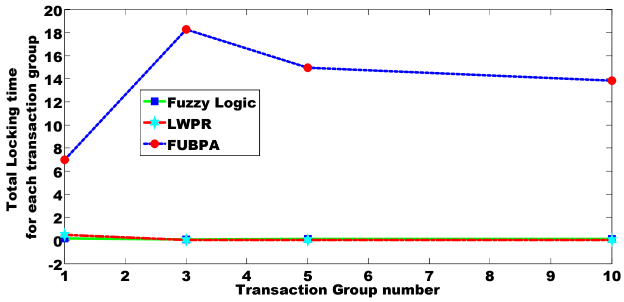

Fig. 4 Total Locking time for each transaction group in Fork using FUBPA/LWPR/FL

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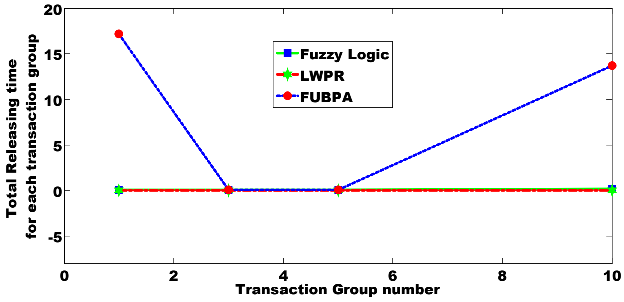

Fig. 5 Total Releasing time for each transaction group in Fork using FUBPA/LWPR/FL

shows overall time consumed for one transaction object.

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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