

DEDICATION

To my...

Parents

Sisters

Brothers

Friends

Teachers

And colleagues.

ACKNOWLEDGEMENT

I thank ALLAH very much, because my work is only a gift from Him.

I'm very thankful to my parents for providing me with confidence, support, and love.

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ABSTRACT

Even with the introduction of parallel computer architecture, the processing speed is restricted by bus constraints and channel bandwidth. One of the solutions to enhance the speed of today's electronic computers is to use optical computing which involves the manipulation of photons rather than electrons

Optical computing based on redundant number representation is expected to be capable of performing high-speed arithmetic operation by exploiting the good features of light such as inherent parallelism, non-interfacing communication, multi-dimensional storage, and ultra-high speed processing.

The purpose of this project is to perform a carry-free parallel arithmetic addition algorithm. Using Modified Signed-digit (MSD) numbers; the carry propagation can be confined in two adjacent digit positions and thus arithmetic operation of arbitrary-length operands can be completed in definite steps and constant time.

The conventional two-operand optical shadow-casting (OSC) technique was used successfully to implement a binary MSD (BMSD) adder. Three-step adder configuration is proposed in this work. The proposed scheme is based on suitable programming of the decoding mask of the OSC system, which is obtained from the derived design equations.

High-level program is used to simulate the optical implementation (i. e. C-language).

تجريد

بالرغم من استخدام الحاسبات المتوازية فان سرعة المعالجه الحالية ظلت محدوده بالقيود التي تحكم النواقل وكذلك سعة القنوات. وكان احد الحلول لزيادة سرعة الحاسبات الالكترونية استخدام الحاسبات الضوئية المتوازيه التي تستخدم الفوتونات بدلاً عن الالكترونات.

ان الحاسبات الضوئية المتوازيه التي تعتمد التمثيل العددي الفائض لها القدره على اجراء الحسابات الرياضيه بسرعه هائلة مستخدمه الخصائص الجيده للضوء مثل المعالجه المتوازيه والاتصالات غير المتداخله وكذلك خاصية الخزن بابعاد متعدده.

الغرض من هذه الدراسه هو ايجاد خوارزميه لانجاز عمليات رياضيه متوازيه خاليه من الفائض. وقد استخدم العدد المؤشر لتجنب انتشار الفائض. التحديد لهذا الفائض يتم باستخدام موضعين متجاورين من الارقام وبذلك فقد امكن الحصول على ناتج العمليات الحسابيه لارقام غير محددة الطول في خطوات محددة وزمن ثابت.

كما تم استخدام تقنية مسرح الظل الضوئية ذات المتغيرين فى تصميم جامع الارقام المؤشره الثنائيه. وقد تم تصميم نموذج ذى ثلاث خطوات. يعتمد التصميم الضوئى على برمجة اقنعة التشفير فى منظومة مسرح الظل الضوئية اعتماداً على معادلات التصميم.

استخدم برنامج بلغة C العاليه المستوى لأستخراج نتائج التطبيقات الضوئية.

List of Abbreviations

ABBREVIATION	DESCRIPTION
1-D	One-Dimension
2-D	Two-Dimension
BCBMSD	Binary Coded Binary Modified Signed-Digit
BMSD	Binary Modified Signed-Digit
CAM	Content Advisable Memory
DM	Decoding Mask
LSB	Least Significant Bit
MSB	Most Significant Bit
MSD	Modified Signed-Digit
OSC	Optical Shadow-Casting
QSD	Quaternary Signed-Digit
SS	Symbolic Substitution

TSD	Trinary Signed-Digit
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