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Chemical Computing

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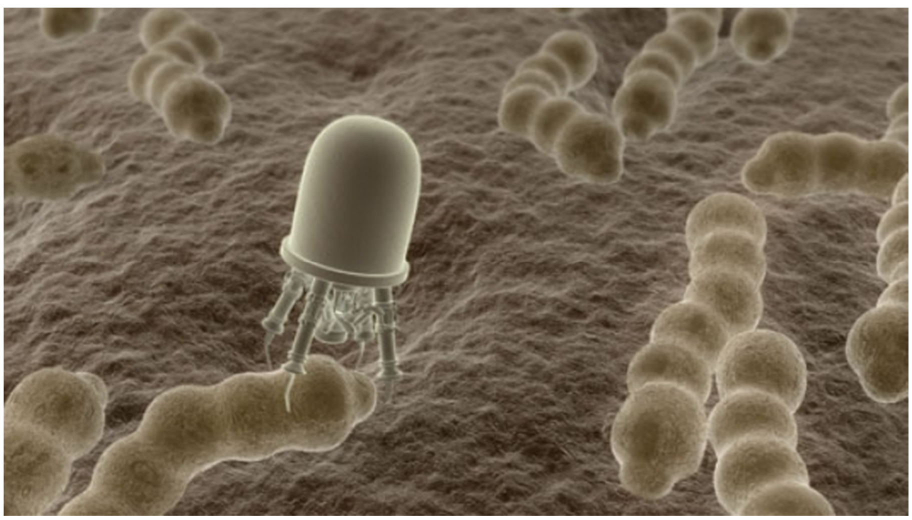
Abstract-Chemical Computing is based upon the flow of electrons through which one can achieve the same result as that of a working computer. It involves the use of the Belousov–Zhabotinsky reaction in which the semi solid soup like liquid act as data pathways for the information to flow around. The research is a current trend prevailing to act as a boon in the coming years and for a better replacement to circuits. Thereby making the speed of data availability to increase and preventing short circuit cases and other problems related to biasing.

I. INTRODUCTION

Gone are the days when we used to bang out head towards the complex structuring of the microprocessor. Where the world of computing stands entirely on the working of circuits and pipelining.Here is the world with power of the BZ (Belousov–Zhabotinsky) solution that allows the computer data to be flowed from one end to another without requiring any kind of circuit or wiring.Let me tell you about the new type of world that is of a chemical computer. This is also called reaction-diffusion computer, BZ computer orunconventional computers which are based on a semi-solid chemical "soup" where data are represented by varying concentrations of chemicals.



The Chemical Programming we here take into account is different from the simple and complex programming techniques.We are not actually going to create programs with real chemicals, rather, we are going to use the metaphor of molecules and reactions to performing computations in general. As we explore this new we of approaching programs, we can step back and see what are the advantages and trade-offs in our using this chemical metaphor in contrast to our traditional programming approach.

Recent work has shown that when two such lipid layers encounter each other as the cells come into contact, a protein can form a passage between them, allowing chemical signalling molecules to pass.

Second, the cells' interiors will play host to what is known as a Belousov-Zhabotinsky or B-Z chemical reaction. Simply put, reactions of this type can be initiated by changing the concentration of the element bromine by a certain threshold amount. The reactions are unusual for a number of reasons. But for the computing application, what is important is that after the arrival of a chemical signal to start it, the cell enters a "refractory period" during which further chemical signals do not influence the reaction.

That keeps a signal from propagating unchecked through any connected cells. Such self-contained systems that react under their own chemical power to a stimulus above a threshold have an analogue in nature: neurons.

II. WHY DO WE NEED CHEMICAL COMPUTING?

The simplicity of this technology is one of the main reasons why it could in the future be turned into a serious competitor to machines based on conventional solid-state electronic hardware. A modern microprocessor is an incredibly complicated device that can be destroyed during production by no more than a single airborne microscopic particle. In a conventional microprocessor the bits behave much like cars in city traffic; they can only use certain roads, they have to slow down and wait for each other in crossing traffic, and only one driving field at once can be used. In a BZ solution the waves are moving in all thinkable directions in all dimensions, across, away and against each other. These properties might make a chemical computer able to handle billions of times more data than a traditional computer.

III. FUNDAMENTAL STEPS IN CHEMICAL COMPUTING TECHNIQUE :

The wave properties of the BZ reaction means it can move information in the same way as all other waves. This still leaves the need for computation, performed by conventional microchips using the binary code transmitting and changing ones and zeros through a complicated system of logic gates. To perform any conceivable computation it is sufficient to have NAND gates. (A NAND gate has two bits input. Its output is 0 if both bits are 1, otherwise it's 1). In the chemical computer version logic gates are implemented by concentration waves blocking or amplifying each other in different ways.

The breakthrough came when he read a theoretical article of two scientists who illustrated how to make logic gates to a computer by using the balls on a billiard table as an example. Like in the case with the AND-gate, two balls represents two different bits. If a single ball shoots towards a common colliding point, the bit is 1. If not, it is 0. A collision will only occur if both balls are sent toward the point, which then is registered in the same way as when two electronic 1's gives a new and single 1. In this way the balls work together like an AND-gate.Adamatzkys' great achievement was to transfer this principle to the BZ-chemical and replace the billiard balls with waves. If it occurs two waves in the solution, they will meet and create as a third wave which is registered as a 1. He has tested the theory in practice and has already documented that it works. For the moment he is cooperating with some other scientists in producing some thousand chemical versions of logic gates that is going to become a form of chemical pocket calculator.

IV. SCOPE

The wave properties of the BZ reaction means it can move information in the same way as all other waves. Thus to perform any feasible computation it is sufficient to have NAND gates and so in the chemical computer version logic gates are implemented by concentration waves blocking or amplifying each other in different ways.The scope is just not limited to the basic reaction process and the facile task but if futher research is done into beforesaid there can be a boon in the coming years sine all complex ciruits and the probems of fixing such issues will not be there.
Moreover,no circuit lines and large current lines connecting the same need to be drawn thoughout the different areas using the same.

Chemical computing in today's world mainly refers to the BZ reaction-diffusion model. Chemical computing can contain elements of quantum computing, but is not necessarily quantum computing.Chemical computing is playing an increasingly important role in areas of biochemical computing, bio-computing, organic computing, and quantum computing.The same technique is also now being applied in image processing.

Another Scientist Adamatzkys applied the similar concept of BZ-reaction to produce two waves creating a third wave and tested the theory in practice and it worked. A Chemical pocket calculator has also been created using thousands of chemical versions of logic gates.Many people have realised the potential of this technology and have found it quite promising.Thus let us all aim ourselves towards achieving a new kind of computing engineering inspired in nature.

V. CONCLUSION

The sum and substance of the research involves the information processing capabilities of chemical systems which are biologically-inspired.The ideal biological computing substrate for constructing such non-classical computers should be made by using chemical reactants such as the Belousov–Zhabotinsky reaction for parallel input of data, parallel output of results thereby exhibiting non-trivial space-time dynamics.

Some common experiments are being conducted under the same which includes spatially distributed nonlinear precipitating systems, excitable chemical systems, e.g. Belousov-Zhabotinsky reaction; proteins as examples of conformation-based computing; tubulin microtubules as collision-based and quantum computers; molecular automata and machines; mono-molecular layers as transducers, memory units and collision-based computers.

Reaction-diffusion computers are fault-tolerant and capable of automatic reconfiguration, i.e. if we remove some quantity of the computing substrate, the topology is restored almost immediately. Chemical and bio-chemical reactions are quite slow, at least at macro-scales, therefore chemical computers could not act as an immediate substitute to conventional silicon computers, but such prototypes of chemical computers will find their applications in medicine, especially in the design and manufacturing of artificial organs.

There will not be wearable parts and speed is another feature to be worked upon that is enhancing the overall efficiency of the computer which lie in the silicon-based systems.

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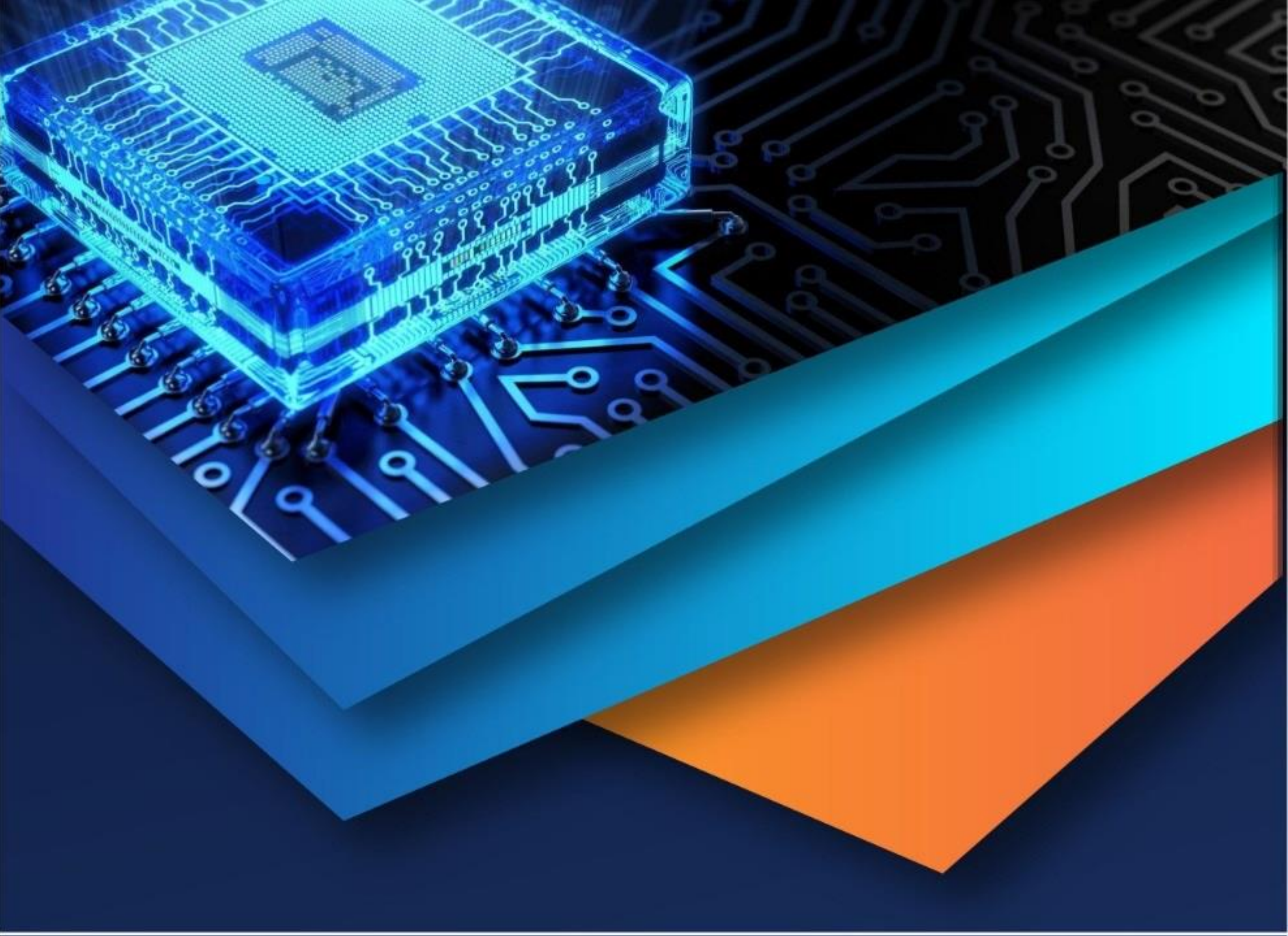

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