RRS Newsletter

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MICROELECTRONIC INTEGRATED CIRCUITS (Part II)

by H. K. Bourne

3. Integrated Circuits in Industrial Electronics

The first large scale impact of integrated circuits in industrial electronics is likely to be in digital computers. The first of these has been announced since the date of this meeting. All computer manufacturers are interested in integrated circuits and as the price falls, a rapid expansion is certain in this field. Thin film circuits will also be used but to a lesser extent, mainly where a low tolerance is necessary. It is believed that by 1969 there should be an appreciable penetration of the market by integrated circuits and by 1974, 85% of the computer circuits should use them.

In the communication field, the future is less certain as radio equipment uses mainly linear circuits and has relatively few applications for digital devices. No industrial radio equipment using integrated circuits is in production at present and only a small amount of prototype work is in progress. The adoption of integrated circuits in this field will be delayed until reliability and cost have been proved without doubt to be better than those presently obtained. Relatively little use is foreseen for the next five years.

In aircraft communication and navigation equipment, development is intense with both thin film and monolithic silicon circuits. It is expected that before 1974, practically all aircraft equipment will be using modular circuits.

For applications in programme and process control equipment, a very long life is required. At present, the equipment is generally of the mechanical analogue type, but there is a trend towards digital circuits. A sharp increase in research and development in this field is expected in the next few years as the cost of the circuits falls. Their first use is likely to be in control applications where digital circuits predominate, but in the analogue field, where the volume of production will be less, there should be applications using thin film circuits. In spite of a rapid expansion in the use of electronics in the programme and process control field, the application of integrated circuits is likely to be rather limited up to 1969, after which time it should increase.

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In test and measuring instruments, no modular circuits are being used at present and few developments are in progress. A move to the use of digital circuits in instrumentation would change the position, but at present most circuits are linear and have close specifications. Integrated circuits are unlikely to be used in instruments unless a definite saving in cost is assured and their application in this field is expected to be relatively small.

4. Integrated Circuits in Consumer Goods

Integrated circuits are beginning to invade the field of consumer goods. It is possible that they will move into every section of this field in the future and that they will offer a challenge as great as any seen so far in electronics. The first practical use by the public is in a hearing aid using six transistors, which is so small that it can be located completely behind the ear. It gives a higher gain than other hearing aids and is lighter in weight, but its main advantages are its increased reliability and stability. It is quite unobtrusive and has good cosmetic appearance. This device, small though it is, is only beginning to approach what is possible. The higher reliability reduces the need for servicing and this is an important factor in modern times, when world-wide servicing facilities must be provided.

In radio and television equipment, tuned circuits limit the use of integrated circuits at present, but alternatives, such as phonon amplifiers, are being developed for I.F. circuits which may assist in this respect. The receiver size will be limited by the audio reproducer, by the tuning system and by the power handling and heat rejection capability. A television receiver requires some critical components and wave shapes at present, and new circuits are needed using current rather than voltage. If these can be made in integrated form, it may be possible to incorporate them completely within the picture tube itself. In all cases, low cost is the key to open the door to microcircuitry in consumer devices.

5. New Developments in Integrated Circuits

In the past, there have been four stages in developing new electronic applications, between the development of the materials and that of the final devices. Each step generally takes about two years, so that the total development time may be six to eight years. With integrated circuits, this cycle may be shortened due to the fusing together of the material field with that of circuits and subsystems.

The cost of integrated circuits is very sensitive to volume of production and also depends on how much of the research effort is diverted away from the main stream, such as in research on gallium arsenide. In addition to low cost, integrated circuits can improve performance and reliability by an order of magnitude.

The cost of an integrated circuit is proportional to the number of components on a given wafer. At present, a 1 in. wafer can accommodate 1,200 components using optical techniques in manufacture. Photo-etch techniques enable some reduction in size to be obtained, but by using electron beams a

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very high resolution is achieved, so that the same wafer can accommodate 100,000 components. Electron beams can also be computer programmed and they can be used to sense the electronic characteristics of the circuits while they are being manufactured. The reduction in size of the components also enables them to operate at much higher speeds than before, of the order of 1 nsec.

Possible ways of making tuned circuits are being investigated, including the use of acoustic resonance in solids. Among the new devices which have been developed, are metal base transistors which have an infinite impedance and light coupling devices which provide complete isolation and will operate at a very high speed.

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JOURNEY TOWARDS THE QUIET SUN
REPORT ON A VISIT TO ISRAEL

Part 3

Tel-Aviv is young but not very beautiful. Starting life in 1909 as a garden suburb of 4000-year-old Jaffa it has now encircled and swallowed its former neighbour and become Israel's largest town, with about half-a-million inhabitants. On the ever advancing outskirts giant mechanical drills are ostrich-like burying their heads in the sand to prepare for the concrete foundations of blocks of flats which will arise in their hundreds on the dunes. Here, as elsewhere in the country, we noticed on the rooftops colourful cylindrical tanks flanked by sloping black rectangles facing south. These were solar water heaters, quite capable in that climate of meeting all domestic hot-water requirements, except perhaps during the occasional rainy spell in winter when an immersion heater would have to assist. Now that cheap off-peak electricity is becoming available in Israel the economics of the present system are more debatable - the sun may be free, but the installation is expensive.

Careful planning and architectural design are clearly evident in the new suburbs in contrast to the by now rather shabby older quarters of Tel-Aviv. A project for slum clearance is under way in which the rubble will be used to push back the sea along a front of over one mile so that a more spacious city may arise. The present one is, however, not devoid of pleasant boulevards and fine public gardens; modern luxury hotels line the shore and skyscrapers are on the way up. A beautiful concert hall, home of a world-famous orchestra, rivals our own Royal Festival Hall. If proof were needed that Tel-Aviv is the cultural hub of the country I would just mention that 'My Fair Lady' (in Hebrew, of course, and allegedly better than the original) was filling the largest theatre and will no doubt continue to do so.

Tree- and shop-lined Allenby Street, the main thoroughfare named after the British General who defeated the Turks in Palestine in 1917, is usually crowded. A complex traffic light system is provided with 'green wave' indicators, showing the speed in km/h at which you should proceed in order to 'catch' the green phase at the next set of lights - if the chap in front gets a move on. Judging

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by the sound of horns punctuated by imprecations in biblical language everybody seems to be intent in blocking everybody else's way. Pedestrians are very obedient and stop at red traffic lights even when no car is in view; if you see anybody disregarding the lights, it is likely to be another British tourist. Crossings near schools are 'manned' at appropriate times by senior boys and girls armed with stop signs and whistles, and they will bravely halt impatient queues of vehicles for the benefit of other pupils.

Tel-Aviv is cosmopolitan but, as has been aptly said, with a touch of the Middle West rather than the Middle East, and with a strong Central European element particularly regarding the numerous cafés displaying superb examples of the pastrycook's art, much to the dismay of reluctant slimmers.

On Friday before sunset everything closes down and buses, coaches and trains stop here as in the rest of Israel (some Haifa buses excepted). The only public transport available on a Sabbath or religious festival is provided by the numerous big American-style taxis. This service, apparently chaotic yet highly organized, caters for destinations in town and also covers interurban routes. Normally you board the taxi at the recognized starting point, sometimes you may hail one of these 'service' cars along the road, or you may be hailed yourself by a driver wanting to make up his full complement of seven passengers. Fares are controlled and not much higher than those of buses or coaches. Once under way you give your money to the nearest co-passenger to pass to the driver who uses periods of enforced idleness, due to lights or jams, or just relies on the good road sense of his car in taking his hands off the wheel to give you change.

Allenby Street is quite deserted on a Saturday and you may cross the road with impunity. In the evening the first buses reappear soon to be packed to overflowing; restaurants, cafés and some shops re-open and long queues form outside cinemas. This old-fashioned phenomenon is, of course, attributable to the absence of television. Sets are for sale, however, and elaborate aerials may be seen on many roofs, particularly in Arab villages, for picking up transmissions from across the border.

Jaffa, one of the world's most ancient ports, has lost many of its unhygienic though picturesque Arab houses near the harbour. Some of those left unscathed by bulldozers have been carefully redecorated and transformed into restaurants and nightclubs. Nevertheless it is still a good place for discovering the oriental way of life in westernized Israel. In premises open to the road men and women are at work making shoes, spraying bedsteads, weaving, polishing furniture or just sorting rags and old iron. The enormous displays of more or less antique brass and copper ware along the narrow lanes of the market are tempting to the souvenir hunter. Backed by the moral support of an Arab-speaking friend we enter one of the tiny shops to have our first experience of oriental bargaining. The old-established rules of the game are

(i) don't show any special interest in the article you desire;

(ii) greet the seller's first terms with polite disdain;

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(iii) state your price (low, but not ridiculously so) as if it were really more than you think the article is worth;

(iv) remain unperturbed when he asserts that it would ruin him financially (your ignorance of Arabic will help you in this);

(v) look at something else or move towards the exit.

Sooner, but more likely later, you may agree on a price somewhere in between the figures first mentioned. Once a bargain is struck you must abide by it. The whole affair is really quite friendly although it may not sound so at times. Happy but exhausted we clutch our parcels and wander off in search of Arab food (about which more next time).

There is just time for a short excursion to the small town of Rehovoth, 20 miles from Tel-Aviv. This former agricultural settlement lies in a region of extensive citrus plantations, and in April the air is heavy with the powerful scent of orange blossom whose white petals appear while the tree is still burdened with fruit. Nearby is the last resting place of Dr. Chaim Weizmann, one of the founders and the first President of Israel. A great scientist in the field of organic chemistry his work proved very valuable to the Allies in World War I. In 1934 he established at Rehovoth the nucleus of the present Weizmann Institute where he managed to do some scientific research whenever his political and diplomatic commitments allowed it. Now the Institute is Israel's main centre of pure and applied research with over 200 projects under way in the natural sciences and other fields, and results of far-reaching importance have been achieved. Here, too, very attractive modern buildings, including a fine Central Library, are set in a beautifully laid-out park at one end of which lies Weizmann's tomb in the grounds of the villa where his widow still lives.

It was, no doubt, due to his influence that science became such a decisive factor in Israel's development, and the superb research facilities available are a remarkable feature of this small country.

History and religion, however, are also powerfully present in this land and nowhere more so than in Jerusalem.

(To be continued)

W. S. Newman

STAFF NEWS

Congratulations to:-

Jan and Alan Johnstone on the birth of their son, Andrew William, on 4th July.

David Willis on his marriage to Miss Margaret Barrell at St. Philip's Church, Worcester Park, on 6th June.

Norman Bates (former member RRS) on his marriage to Miss Janet Hastings on 2nd July.

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Welcome to:-

New Staff

Mrs. M. Nicholls	T./C.O.
J.M. Bruce	T./S.A.

Vacation Students

Miss McIntosh
Mr. Paulson
Mr. Fidler

Resignations

Mr. A.W. Hudson	T./Specialist Teleprinter Operator
Miss S.J. Hatch	T./C.A.

SPORTS AND SOCIAL CLUB

The beginning of another month, and time once again to report the progress of the committee.

It is hoped to erect a cigarette machine in the near future, this will be of the two column type and will sell popular brands.

The Car Rally, which is counted as part of the Smith-Rose cup, is being organized this year by John Reed to be held at the beginning of September.

Do you have difficulty in keeping warm in the winter? During the winter months, Miss Scott is hoping to hold Scottish Country Dance Sessions. It must be emphasized that no previous experience is necessary.

J. Juleff

Tennis

Unfortunately the weather interfered with the tennis match against RRL which was held on 20th June. However RRS established a winning lead of 5 to 2 with two to play. Our team consisted of:

Mr. and Mrs. Horner
Dr. Bryant and Miss Peart
Mr. R.W. Smith and Miss Williams

The return match will be played later in the season.

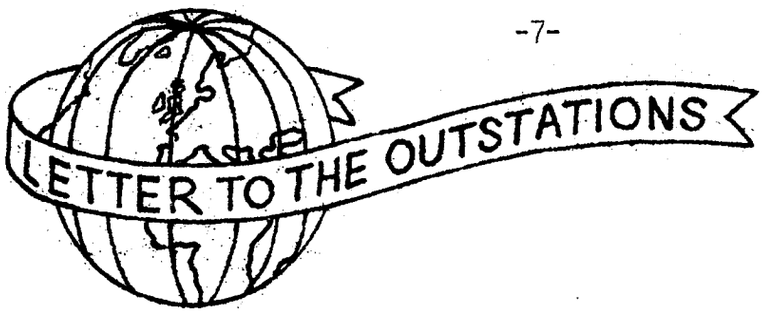
Earlier an evening match on 9th June against a Denham Club resulted in a win for RRS by 3 matches to 1, the team being:

Dr. Bryant and Miss Peart
Mr. R.W. Smith and Miss Williams

You are reminded that Margaret Peart is now accepting tennis subscriptions - £2 for the whole season. The visitors' fee is a nominal 2/- per session, but no member of RRS may make more than 3 'visits'.

It is intended to hold a mens and ladies singles tournament this year with preliminary rounds played in the evenings if necessary. To get some idea of the amount of support, those interested are requested to put their names on the list provided on the main-corridor notice board as soon as possible.

P. A. Smith



Dear Colleagues,

From last month's edition you may remember the fact that 347 visitors came to R.R.S. during Open Days, and a further large number of friends and relatives were able to come on Saturday, 13th June. Further research into our audience rating reveals that Winkfield had 218 guests, not all of them the same ones who visited Ditton Park. All this means that probably nearly 400 people came to see one aspect or other of our work. For our Saturday congregation a sufficient quantity of machinery capable of producing light, noise, movement, or any combination thereof was found to occupy the younger generation, and all age groups became fully occupied with an excellent tea provided by members of the Sports and Social Club.

Among more recent visitors we have been fortunate in having Dr. Budden and Dr. Weekes staying here as consultants for some days. Dr. Budden has given a series of lectures on 'Waves in the Ionosphere' and Dr. Weekes will lecture on 'Temperatures in the Ionosphere'.

Apropos open days, there was on show a device of polished wood and brass; a wireless apparatus of Victoria's reign. No prizes are awarded for guessing that this exhibit was not unconnected with

Yours sincerely,

The Editor

This Month's Useless Facts

1. The world sausage eating record is 162½" in 40 min. 40 secs., by an undergraduate at St. Andrews University.
2. Kingston Technical College Students have squeezed 27 people in a Wolsely 6/110.
3. 1% of women aged 25-44 years eat pickled onions for breakfast.

Collected by J.N. Tyler