Foreword

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There has been spectacular progress in the technology of displays based on liquid crystals since these strange materials, regarded at the time as of only academic interest, were first suggested as the basis of flat screen display devices. Liquid Crystal Displays vary in sophistication from humble black and white wristwatch and calculator displays through to the exceptionally high quality colour displays used in applications such as notebook PCs and flat screen televisions. It is hard to disagree with the statement that LCDs are now an integral part of the everyday life of most people. The progress made by the LCD industry has been the result of inventions and developments by many researchers spanning several scientific disciplines. One can point to the crucial role played by new materials, novel device structures, device improvements, new driving technology and, not least, new production techniques, all underpinned by progress in understanding the fundamental physics and chemistry of liquid crystal materials.

The very success of LCD technology raises a serious question that must be answered. LCD technology has now risen to the level where it is not only the dominant flat panel display technology, it is starting to rival the traditional Cathode Ray Tube as the overall dominant display technology. So we must ask the question: ‘Has LCD technology reached a level of maturity such that developments are becoming incremental?’ Some suggest the answer to the question should be: ‘Yes’. However further investigation often reveals that these people are rarely unbiased; they are often researching a rival display technology, and trying to raise funding for it by increasing the level of interest in their own technology at the same time as criticising the opposition. I am firmly of the belief that the answer to the question has to be a definite: ‘No’. Liquid Crystal Displays are a resilient technology in the sense that they have already responded to a large number of perceived limitations with a constant stream of developments; some evolutionary and some revolutionary in nature. Their resilience comes

from the versatility arising from the rich diversity of phases and device structures possible with liquid crystals. This tremendous diversity is not always appreciated by those outside the field who sometimes make the mistake of thinking of Liquid Crystal Displays as a narrow well-defined technology.

This Special Issue of the Sharp Technical Journal is devoted to Liquid Crystal Displays and provides a fascinating insight into the new developments in the technology and applications of LCDs. Two introductory articles set the scene by reviewing current trends in the technologies and applications of liquid crystals. Four R & D theses then consider some key new developments in the areas of components, driving circuitry and production issues for improving the performance, resolution and functionality of Liquid Crystal Displays. The thesis on hardware for 3D displays illustrates well the tremendous versatility of liquid crystal materials. The authors have used the ordered properties of liquid crystal molecules to fabricate a large area patterned retardation element that forms a parallax barrier in a 3D display. This novel optical component uses a subtle piece of molecular engineering made possible by the spontaneous ordering of molecules present within the liquid crystal phase.

The technical papers give overviews of five important areas of new technology and their applications. We are told how the viewing angle of LCDs has been improved to a point where it is no longer an issue and how novel LCD structures designed jointly in Japan and the UK have recently been introduced as very low power reflective colour displays. The other three papers show the progress made in realising the long-held dream of flat panel TV. One paper describes a 20” LCD suitable for ‘hang on the wall TV’ and a second a 42” Plasma Addressed LCD (PALC) for large area direct view flat panel displays. The third paper discusses a new optical engine using the exciting new development of Continuous Grain Silicon (CGS), a technique which produces high mobility silicon over large areas, to generate very large area rear projection TV displays. The final section reviews some of the fascinating new LCD based products recently announced by Sharp and gives an idea of what we can expect to be able to buy within the next year.

This special issue gives us a tantalising glimpse of some of the developments in LCD technology and applications currently taking place within the laboratories of Sharp, the company which has done more than any other to bring LCDs to the pre-eminent position they currently hold as the dominant flat panel display device. I strongly commend the Special Issue to you; it makes fascinating reading.