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The Development of Motion-tracking Strategies for Cineradiographic Images

A thesis is presented in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Technology at Massey University.

by

Wyatt H. Page

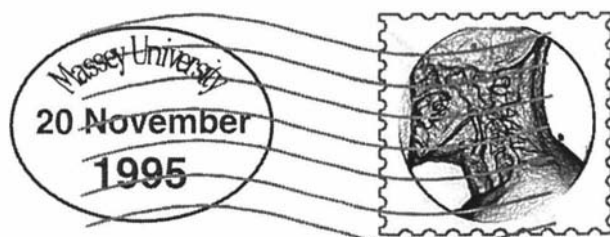
The Development of Motion-tracking Strategies for Cineradiographic Images

Wyatt H. Page

Department of Production Technology

Massey University

NEW ZEALAND



Abstract

This research describes the development of motion-tracking algorithms for a new dynamic spinal motion analysis system. This system utilises digital image processing techniques to extract motion parameters from video cineradiographic sequences of the human spine. The automated tracking of vertebral motion results in accurate assessment of translational and rotational displacement. This has been verified by extensive testing on prescribed motion sequences generated by a digital image warping based algorithm. The use of the motion measurement system provides a new tool for spinal health care professionals in the diagnosis of spinal dysfunction.

Key words -

cineradiography, image processing, motion-tracking, computer graphics, spinal kinematics.

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Preface

In the beginning (assuming there was a beginning) there was.... whatever there was!

And much, much later I came along, courtesy of my father, a man who inspired me with a talent for almost anything requiring mental skill, creativity and mental dexterity. Nurtured by my mother, a very talented person in her own right, whose greatest talent was her love for life and almost everything in it, I was exposed to many marvellous things and in particular electrical devices and electronics caught my fancy.

My father (the *mad* experimenter) introduced me to the joys of electrocution either by design in the form of a Tesla coil or Windhurst machine or by accident in being reminded that the anode voltage on a UX-807 (an old tetrode indirectly heated vacuum tube of the 1935 era) in an audio amplifier is more than enough to give you a lift in life. It was probably this 'lift in life' that I received on a not too infrequent basis that gave me a head start on many of my friends. At age nine I had not only built many a crystal set but had begun to design better ones, covering a variety of frequencies from longwave to shortwave. One of my first real joys was building a single-triode super-regenerative receiver (one of Colonel Armstrong's many genius ideas). It has such economy of parts and performance that I could scarcely believe at the time plus it could pickup both AM and FM signals. Through this sort of endeavour from receivers to transmitters and lots of audio amplifiers in between, I acquired (guided by my father) the *old* language of electronics and its handicraft.

It will be, in all probability, almost 10 years to the day that I received my first degree (BE Electrical - first class) that I will be receiving my second degree for the work contained in this volume. When I completed my first degree I had had enough of University and yearned for a job and some money (not an unusual feeling, I'm sure!). This led me to work for four-and-a-half years for a small but diverse electronics manufacturing and design company in which my industrial skills were honed and I met a lot of nice people. Later I joined the Production Technology Department at Massey University where I completed this work and met even more nice people!

It was on 19 July 1989 that I began this work (serendipity had its way) and early the following year I attended the wedding of my best school friend who had also chosen to study and work in electronics. Tragically only three months later he was dead with cancer. So before I continue I will remember Ross Winton Jamieson, '*Rosco*' to his friends, a very talented person who on days like this is badly missed. May the morphic resonance of your being *ring* somewhere in the universe.

So in closing, I hope that the reader (may there be many of you in the future) finds the story that unfolds is done right and done well.

Wyatt Page 14 November 1995



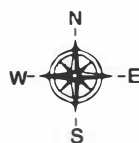
Dedication

A philosopher being asked what was the first
thing necessary to win the love of a woman
answered: "Opportunity."

Thomas Moore

To opportunity, may I always know you
when we meet.

WHP



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I wish to thank the following people

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Brent Foster helped me out of those tricky Windows programming problems.

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My family - now you will see me more often.

