DOWNLOAD PDF THE THEORY OF CRITICAL DISTANCES

Chapter 1 : Theory of Critical Distances TCD Extension v1 - FEA, CFD and Explicit Dynamics

This chapter examines the theory of critical distances (TCD) with a brief history of the subject and describes a number of theories, which can all be described as critical distance theories. TCD is a group of methods, all of which use linear elastic analysis and a constant critical distance.

This is the first half of the second article in my Fundamentals of Fighting series for Omni Movement. The introductory article discussed the difference between fundamentals and basics, and this article begins my deeper analysis of each of the three main fundamentals that I outlined--distance, timing and positioning. Please check out the blog for the full article, as well as the first one if you missed it: There are many complex factors at play when controlling distance. Fighters need to be taught important skills such as measuring distance and manipulating distance in order to control it. Critical distance is a universal concept that is found in all styles of combat. While the precise definition varies somewhat from style to style, the general idea always remains the same: It is obviously impossible to constantly maintain the same range for the entire fight, but if the fighter is able to ensure that the majority of exchanges take place at his preferred range, then he will almost always win the fight. The pertinent question at this point is what determines critical distance? Some might answer that question by saying the build of the fighter. Taller fighters are better on the outside and shorter fighters are better on the inside, right? Thus, critical distance is more accurately determined by what tools the fighter prefers to attack with. Granted, the build of the fighter has a significant influence on which tools he develops. A tall fighter with long limbs will often prefer straight punches and straight kicks, while a shorter, more compact fighter may prefer tight hooks, uppercuts and low kicks. However, there is enormous variation in skill-sets and styles even among fighters of similar builds, making critical distance unique based on the preferred weapons of the individual. It is helpful to have a general understanding of range. Different styles will break distance down into different ranges. Personally, I prefer to break range down into three categoriesâ€”long range, medium range and close range. The reason I prefer this system is that it is a little more flexible and accounts for multiple strikes being thrown within the same ranges. To account for this variability, I say that fighters either like to fight on the outside long range , in the pocket medium range or on the inside close range. In the second half of the article, I examine how two underdogs dethroned dominant champions through their superior control of critical distance:

Chapter 2 : The Theory of Critical Distances

The Theory of Critical Distances will be of interest to a range of readers, from academic researchers concerned with the theoretical basis of the subject, to industrial engineers who wish to incorporate the method into modern computer-aided design and analysis.

I was thinking about the problem of predicting fatigue limits for specimens containing notches and short cracks. It was already known that some notches â€" the relatively sharp ones â€" behaved much the same as cracks, whilst other, blunter notches behaved quite differently. I realised that I could make accurate predictions for both types of notches if, instead of looking at the stresses at the notch root, I shifted the focus of my attention slightly, to a point nearby. By choosing a suitable distance away from the notch, and using the stresses at that point, I found that the behaviour of both blunt and sharp notches could be predicted. Combining my original ideas with some LEFM concepts, I was able to predict a value for this critical distance from first principles, allowing predictions to be made a priori. It is my custom, if I have a good idea, to jump in the air and click my heels together; that day I jumped so high I hit my head on the ceiling. I soon found, however, that I was not the first person to walk down this particular road. Indeed the same basic idea â€" using stress values within a material-dependant critical distance from the notch â€" had been proposed as early as the s and was the basis for the notch sensitivity rules devised by Neuber, Peterson and others. Although I was aware of these rules â€" they are widely used in industry â€" I had not appreciated that they were based on critical distance ideas because the form in which they are normally presented obscures their origins. I also found that the link between critical distance theories of notch behaviour and fracture mechanics concepts for crack behaviour had previously been made by researchers as far back as the s. Further research on my part showed that the same basic idea had been invented, several different times and quite independently, by workers not only in the area of fatigue but also in the field of brittle fracture in polymers and composites. This encouraged me to investigate the use of the method in areas which had not previously received much attention, especially brittle fracture in metals and ceramics, fretting fatigue and fatigue of polymers, and also to apply the method to problems in the design and failure analysis of engineering components. But it was a theory which had no name, a quiet, shy theory whose proponents were largely unaware of each others work. I decided to give this theory a name â€" the Theory of Critical Distances TCD â€" and to do what I could to develop and enhance its use and to make others aware of its existence. Hence this book, which is the first, but I hope not the last, to treat this topic. LEFM was born in the work of Griffith, beginning in the s. It faced many difficulties and setbacks, for example its application to fracture and fatigue in metals was resisted on the grounds that it could not take account of plastic deformation at the crack tip. But over the decades LEFM developed into a large undertaking, used extensively in industry and the subject of many books and university courses. It developed because it was able to make predictions of experimental phenomena which people needed to know about, especially the growth rates of fatigue cracks, and to define quantitatively the important mechanical property of toughness. These successes provided the stimulus to develop a theoretical understanding which acted, retrospectively, as a justification for the theory. The TCD, on the other hand, though it began almost as long ago, did not develop into a coherent science in the same way. Although it is used industrially in the form of certain empirical equations, and more explicitly by a few individuals, it has not received the same attention as LEFM and consequently has not developed the all-important theoretical foundations that would inspire confidence. This book is a first attempt to redress the balance, to bring together in one volume everything that we know about the TCD. Here I will be advocating a particular approach, firmly grounded in continuum mechanics, which emphasises the links between the TCD and LEFM, and allows me to develop a justification for the TCD on theoretical grounds. This is by no means the only way to use critical distance concepts, and I will be discussing and comparing a variety of approaches advocated by other workers: The structure of this book is as follows. The first four chapters form an introduction to the TCD and to other theories used to predict material failure. The next six chapters examine different aspects in detail, covering brittle fracture in ceramics, polymers, metals and composites and also covering failures due to fatigue and contact problems such as fretting. In each of these chapters the basic idea is the same, to first demonstrate how the TCD can be used to predict experimental data and, having established its success and noted any shortcomings, to discuss these results in the light of the known mechanisms and theories of failure. Chapters 11 and 12 consider the complications that arise in multiaxial stress fields and in real engineering components, providing a number of case Preface xv studies. Finally, in Chapter 13, findings from the previous chapters are brought together to consider the theoretical basis of the approach. When writing a book it is useful to imagine who may read it. I have considered two different types of reader; the first is a researcher working in a university or large company, who is interested in understanding material failure at a fundamental level. The second is an engineering designer who requires a practical tool for predicting failure in real components and structures. These two readers will approach the book in different ways, focusing on different chapters, but I hope that both will find something useful. Many people helped with this work. I would like especially to mention three individuals who made pivotal contributions: Luca Susmel, Pietro Cornetti and Danny Bellett â€" it has been a particular pleasure to work with you guys. Many others contributed to the work of my group through their research theses on critical distance concepts, including Wang Ge, Niall Barrett, Susanne Wiersma, Giuseppe Crupi and Saeid Kasiri. However, at the end of the day it was I who wrote the book and who therefore must be responsible for the errors and omissions which it surely contains. I would like to finish with a big thank you to my wife, Niamh, without whom I could never do anything at all. Symbols different from these appear from time to time in cases where I have quoted from other authors, using their nomenclature; in these cases the symbols are explained as they appear. The Ritchie Knott and Rice model Ultimate tensile strength Specimen width Strain energy Notch angle Crack growth increment used in FFM Range of cyclic stress Fatigue strength of a plain specimen Fatigue strength of a notched specimen nominal stress Range of cyclic stress intensity Fatigue crack propagation threshold Exponent used in describing the stress field of a sharp V-shaped notch Angle defining the path along which r is measured Root radius of a notch or other stress concentration feature Stress; unless otherwise specified this is the nominal stress when applied to a notched or cracked specimen Fracture stress: Examples of ductile fracture left and brittle fracture right in bolts Wulpi, Nevertheless, in this chapter we will briefly review the background material and introduce symbols and terminology, which will be used in the rest of the book. We will be concerned, in general, with the deformation and failure of materials under stress, but emphasis will be placed on those types of failure which will be the main subjects of the book, especially brittle fracture and fatigue, but also including 1 The Theory of Critical Distances 2 ductile fracture and certain tribological failure modes such as fretting fatigue. Of special interest from a mechanics point of view will be cracks, notches and other combinations of geometry and loading, which give rise to stress concentrations and stress gradients. In this respect, the use of computer-based methods such as finite element analysis FEA will also be discussed. We will finish with critical appraisal of the use of traditional fracture mechanics and solid mechanics in failure prediction, setting the scene for the developments to be described in the rest of this book. Most materials display a region of linear, elastic behaviour at low strains, and in some cases line 1 this continues all the way to failure. This is the behaviour of classic brittle materials such as glass and certain engineering ceramics. More commonly, some deviation from linearity occurs before final failure line 2. This non-linearity has three different sources: This happens when damage such as splitting and cracking becomes widespread, for example in fibre composites. Finally, some stressâ€"strain curves display other features line 4 such as a drop in stress after yielding in some metals and polymers and a long post-yield plateau terminating in a rapid upturn in stress just before failure:

Chapter 3 : Theory of Critical Distances and Design Validation | echobio

The theory of critical distances (TCD) proposes that the failure of a body containing a stress concentration (e.g. a crack or notch) can be predicted using elastic stress information in a critical region close to the notch tip.

Chapter 4 : Fundamentals of Fighting: Critical Distance : MMA

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IntroductionAs far as the author is aware, the first attempt of using the theory of critical distances (TCD) to predict fatigue strength of notched mechanical components was made by Neuber, in Germany at the beginning of the last century.

Chapter 5 : The Theory of Critical Distances - PDF Free Download

The Theory of Critical Distances (TCD) is a general term for any of those methods of analysis which use continuum mechanics in conjunction with a charac- teristic material length constant, L.

Chapter 6 : The theory of critical distances : a new perspective in fracture mechanics in SearchWorks catal

the theory of critical distances: a brief introduction hat follows is a very brief introduction to the TCD: further details are available in [1] and in many other recent publications.

Chapter 7 : Theory of Critical Distances - A New Perspective in Fracture Mechanics - Knovel

The Theory of Critical Distances (TCD) is the name which I use to describe a group of methods employed for the prediction of failure in cases where stress concentrations are present and where the failure mode involves cracking, such as fatigue and brittle fracture.