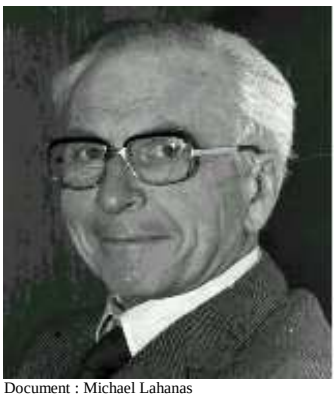
Pr. John Hadji ARGYRIS
(1913-2004)



Document : Michael Lahanas

J'ai eu la chance de bien connaître John Argyris. Ma première rencontre remonte à 1970 (eh oui) quand, ingénieur débutant dans une société de services qui utilisait ASKA, logiciel éléments finis général à l'architecture innovante, j'eus ma première réunion à l'ISD[1] de Stuttgart. J'étais totalement fasciné par le personnage. Au cours d'une longue collaboration, nous avons établi progressivement des liens d'amitié. C'était un personnage étonnant, aux multiples facettes. Il était extrêmement curieux et n'aimait pas qu'un domaine lui échappe ou lui résiste. Il recherchait l'originalité et l'élégance des formulations, comme par exemple la fameuse approche par modes naturels[2], élégante introduction de fonctions de forme qui a dérouté plus d'un de ses lecteurs, les éléments de coque Sheba 3 et 6 à 18 degrés de liberté par nœud, les algorithmes d'intégration dans le temps à grands pas de temps. Il était fasciné par l'école mathématique française.
C'était un esprit d'une très grande culture dans le domaine de la peinture, de l'architecture et la décoration intérieure, de la littérature en particulier. Il aimait beaucoup la littérature française et je me souviens que, lors d'un toast au banquet d'un congrès à Stuttgart, il cita longuement Vauvenargues, moraliste français du 17e siècle, qu'il connaissait parfaitement ! Il parlait assez bien un grand nombre de langues (sept je crois). Nous avions également de longues conversations sur la vie politique en France.

Je garde de lui précieusement deux publications :

- *Energy theorems and structural analysis, A Generalised Discourse with Applications on Energy Principle of Structural Analysis Including the Effects of Temperature and Non-Linear Stress-Strain Relations*, publié (*Butterworth*) en 1960 (avec S. Kelsey) mais reprenant des articles de 1954 et 1955[3]. Les méthodes force et déplacement y étaient déjà exposées, avec prise en compte des non-linéarités de comportement.
- *Recent advances in matrix methods of structural analysis*, (Pergamon Press) en 1964. L'essentiel des fondements des calculs statiques, y compris le flambement et l'élastoplasticité y est présenté. Curieusement, bien que l'on y trouve les matrices de rigidité d'un certain nombre d'éléments (barre, membrane, panneau de cisaillement), le terme éléments finis n'apparaît jamais. La structure d'un code éléments finis est clairement décrite et pour l'essentiel, toujours d'actualité. Des références au calcul dynamique figurent également dans ce texte.

C'était un homme d'une grande élégance, un esthète, un esprit universel comme on en rencontre peu.

François Besnier
Principia Marine
1 rue de la Noë
BP 22112
44321 Nantes Cedex 3, France

Directeur Scientifique et Technique
Francois.Besnier@principia.fr

[1] **I**nstitut für **S**tatik und **D**ynamik der Luft- und Raumfahrtkonstruktionen (Institut pour la statique et la dynamique des constructions aéronautiques et spatiales)

[2] Finite Element Method – the natural approach; J.H. Argyris and al. (*Computer methods in applied mechanics and engineering* – **1979**)

[3] Energy theorems and structural analysis *(Aircraft Engineering* – **1955***)*

Hommage de l'Université de Stuttgart

Als Vertreter der Fakultät für Luft- und Raumfahrttechnik und Geodäsie der Universität Stuttgart ist mir die ehrenvolle Aufgabe übertragen worden, die Verdienste unseres Kollegen John Argyris zu würdigen.

John Argyris studierte Bauingenieurwesen zunächst in Athen und dann an der Technischen Universität München, wo er sein Studium 1936 mit einem exzellenten Diplom abschloss. Seine erste Stellung trat der junge Diplomingenieur bei der Firma Gollnow in Stettin an. Hier wurde der Projektingenieur Argyris gleich mit einer fast unlösbaren Aufgabe betraut. Es ging um den Entwurf und die Berechnung eines 325 m hohen abgespannten Funkmastes mit einem runden Gebilde von 25 m Durchmesser an der Spitze für den damaligen Deutschlandsender. Hier zeigte sich bereits die Genialität von Prof. Argyris. Er wies auf das bis dahin unbekannte Phänomen des Drillbiegeknickens solcher Masten hin und veröffentlichte seine Erkenntnis in der Zeitschrift Stahlbau 1940.

Es war klar, dass ein so intelligenter junger Mann nach Höherem strebt. Nach weiteren Studien in Berlin und Zürich hat er sein Wissen auf den Gebieten Luftfahrt, Mechanik, Mathematik und Physik vertieft. 1943 trat er in die Forschungsabteilung der Royal Aeronautical Society ein, wo er die Struktur- und Flatterabteilung leitete. Ab 1949 arbeitete er als Dozent für Aeronautical Structures (Luftfahrttragwerke) am Imperial College of Science and Technology der Universität London, dort übernahm er 1955 den neu eingerichteten Lehrstuhl Aeronautical Structures. Es war der erste Lehrstuhl dieser Art im Commonwealth.

Im Jahr 1959 folgte John Argyris dem Ruf an die damalige Technische Hochschule Stuttgart und gründete das Institut für Statik und Dynamik der Luft- und Raumfahrtkonstruktionen (ISD). Nach dem Umzug in ein eigenes, großzügig ausgestattetes Gebäude im Pfaffenwaldring 27 begann sozusagen das "goldene Zeitalter" des Instituts. Die wissenschaftliche Weitsicht von John Argyris begründete den weltweit hervorragenden Ruf dieses Instituts.

Argyris wollte eine computerorientierte Berechnungsmethode schaffen, mit der Probleme der statischen und dynamischen Berechnung von Tragwerken mit numerischen Methoden gelöst werden konnten. Die führte zur Methode der finiten Elemente, die von John Argyris maßgeblich begründet wurde. Diese Methode, bei der ein Tragwerk durch geometrisch einfache Elemente wie Dreiecke, Vierecke oder Tetraeder und Hexaeder idealisiert wird, war damals Pionierarbeit.

Das Ziel, den Computer für die Berechnung von Luft- und Raumfahrzeugen einzusetzen, hat er mit großer Intensität betrieben. Dass dies ein Erfolg wurde, ist sowohl seinen Führungsqualitäten als auch der großzügigen Unterstützung durch das Land Baden-Württemberg zu verdanken.

Aber die Forschungsinteressen von John Argyris reichten weit darüber hinaus. Er hat zur Schaffung und zum hohen Ansehen der Fakultät für Luft- und Raumfahrttechnik beigetragen, der er viele Jahre als Prodekan diente und zu deren bekanntesten Mitgliedern er zählte. Für alle Institute stand immer ein Großrechner zur Verfügung, was zu idealen Arbeitsbedingungen führte.

Aber auch die Gründung des Rechenzentrums der Universität ist mit seinem Namen verbunden.
Ein äußerst wichtiges Anliegen war ihm darüber hinaus immer die produktive Zusammenarbeit von Universität und Industrie, was politisch nicht immer gewollt war, aber für praxisrelevante Forschungsthemen sehr wichtig war und auch heute noch ist. Vom Lehrstuhl in London wurde er 1975 emeritiert, aber in Stuttgart wurde ihm nach der Emeritierung 1984 das ICA (Institut für Computeranwendungen) eingerichtet.

Prof. Argyris war immer ein hoch geschätzter akademischer Lehrer, der nicht nur Studierende, sondern auch Wissenschaftler für sein Fachgebiet zu begeistern wusste. Seinen sehr guten Vorlesungen musste man allerdings mit großer Aufmerksamkeit und hoch konzentriert folgen.

Für sein wissenschaftliches Werk erhielt John Argyris zahlreiche Ehrungen (zahlreiche Ehrendoktoren und Ehrenproffessuren) und Auszeichnungen, von denen ich nur drei erwähnen möchte: die Verdienstmedaille des Landes Baden-Württemberg, den Einstein Award, eine der höchsten Auszeichnungen der USA und zuletzt die höchste Auszeichnung der Ingenieurwissenschaften in Großbritannien, die Prince Philip Gold Medal der Royal Academy of Engineering. Sie wurde ihm am 27. November 1997 von HRH the Prince Philip persönlich überreicht.

John Argyris hat nicht nur auf dem Gebiet der Luft- und Raumfahrttechnik, sondern im gesamten Ingenieurwesen unschätzbare Pionierarbeit geleistet. Die Universität Stuttgart hat mit ihm einen großen Lehrer und Forscher verloren. Wie sagte ein früherer Rektor: Den Ruf einer Universität begründen die Genies - und John Argyris war eines von ihnen.

Hommage 9 mai 2004

Ingolf Grieger

Professeur, Institut für Statik und Dynamik der Luft- und Raumfahrtkonstruktionen

Fakultät Luft- und Raumfahrttechnik und Geodäsie
Pfaffenwaldring 27
70569 Stuttgart, Deutschland

Grieger@isd.uni-stuttgart.de

A small view of the life of John Argyris - Engineer Extraordinaire

John Argyris was born in Volos (19/08/1913), Greece, into a Greek Orthodox family of mathematical notorieties. Indeed, his great uncle was Professor of Mathematics Constantin Caratheodory (1873-1950) of the University of Munich, a world-renowned mathematician and recipient at the time of the world's highest mathematical honour. After studying engineering for four years at the Technical University of Athens, Argyris's father decided to send him to Germany to complete his studies. His mother wanted him to go to England for this purpose but John Argyris's authoritarian father insisted that he went to Germany. There were two reasons why his mother wanted him to go to Britain. Firstly, her sisters were living there (unknown at the time one of his aunt's sons would give his life as a British pilot in the Battle of Britain) and his younger brother was serving in the Royal Navy. Secondly, John Argyris had a great contempt for the Nazis and what they stood for in pre 2nd World War Europe. He completed his Diploma in Engineering at the University of Munich with a pass of 9.95, the maximum being an unprecedented 10. Indeed, the German professors said that they were completely astonished at John Argyris's capabilities and his work at such an early age. He then looked for the first time in his life for employment in the world-at-large. He was employed by a private consulting organisation working at the leading-edge technical design of highly complex structures. One of these early incredible engineering accomplishments was that of designing a 320 metres high radio transmitter mast with a heavy mass concentrated at the top - at the time an irresolvable problem.

His dislike of the Nazis continued. John Argyris became a marked man as he would not stand up and make the German salute every morning as laid down by the Nazi regime. This and his outspoken ways made him a man that the Nazis took note of and watched discretely. This was a dangerous position to be in, in pre-war Germany. Indeed, as it become increasingly likely that war would break out in Europe again and John Argyris saw the growing atrocities of the Nazis at first hand, he knew that he had to try to do something to stop this aggressive and subversive dictatorship dominating a future world. High ideals but ones perfectly at home with John Argyris. The engineering firm that he worked for was dealing with German secrets insofar as they knew exactly what the Germans were doing at the design stage of their projects and their end results. British Intelligence would eventually use these secrets. His mother said that he was in grave danger of his life if he stayed in Germany any longer. Unfortunately as plans were being made for his mother and himself to return to Greece, war did indeed break out. He was then working in Northern Germany where one of his first actions in helping others and risking his life was when a desperate parent and friend asked him to try and save around thirty young German women aged between 15 and 25 years, all with a Jewish heritage, from the Nazi tyranny. John Argyris decided that the only option open to them was to get them to a then free nation. The nearest was at that time Denmark. He enlisted the help of a friend who loaned him the use of a motor boat. The boat filled to capacity and unfortunately John Argyris had to leave more than the boat could carry, including the parents of the children. This secret attempt for freedom and 'life' carried out in the dead of night was successful. If he had been caught, John Argyris would have been hanged. As war was progressing in Europe and the Germans knew of John Argyris's great worth, they asked him point blank to help them in their war efforts. He refused, bringing upon himself the wrath of the Nazis. He knew that he had to move swiftly and to an environment where he would be safe. The only place close was the Greek Embassy in Berlin. What he had heard and been told by the Germans he put to good use. He told the officials that it would not be long before Greece was invaded and passed on a great deal of secret German information. (Three months later he would be proved correct as Greece was invaded and conquered by the Nazis.) John Argyris was flown to Greece on what was supposedly official embassy business where this important information was passed onto the British Ambassador to Greece, Sir Michael Palairet. Sir Michael said that Argyris had to leave because it was far too dangerous for him to stay if the Germans found out about his work for the Allies.

John Argyris flew back to Berlin as he had no alternative. On arrival in Germany the secret police were unfortunately waiting, they approached him and told him he was an enemy of the state. John Argyris was sent to one of their infamous concentration camps. After four to five weeks he escaped during an RAF attack on the camp after which he contacted a high ranking friend and contact in the German war machine - Admiral Kananis. John Argyris knew that he was a fanatical anti-Nazi and also of Greek origin, but who had kept his personal feelings extremely close to his chest for obvious reasons. Admiral Kananis said that he would help John Argyris escape from the Nazis and attached one of his officers to him (a Colonel in the Army) who also had an intense hatred for the Nazi regime. The Admiral also gave John Argyris special papers and a visa to enter and stay in Switzerland as long as he wanted. Over a three week period both the officer of the Third Reich and John Argyris walked through the vast part of Germany until they arrived at the Swiss frontier barred by the Rhine in South East Germany. The officer said that he had to swim to Switzerland to gain freedom. John Argyris's second example of his heroic spirit was to talk seven others into swimming with him - five reached Switzerland with him. The Rhine was icy cold at that time of year and was made even colder by the dissipation of iced waters flowing continuously from the Swiss mountains.

On arrival at the Swiss side of the Rhine he was captured with the others and the soldiers told him that they would all be interned and sent back to Germany as the Swiss did not want any problems with Nazis themselves. On arrival at the Swiss interrogation centre the authorities found two things that changed their minds to send John Argyris back to Germany. Firstly the Swiss found a dossier on him and secondly and probably the more important at that time, was that he possessed a visa issued through one of Germany's highest ranking military officers. Admiral Kananis and the Colonel Dohnanyi were executed under the direct orders of Hitler six months later.

Not knowing anyone in Switzerland and thinking that he was in relative safety, John Argyris bided his time before he embarked to England by enrolling at the Technical University of Zurich where he completed their two year Doctor of Science higher course in engineering in a mere 6-months and was awarded the university's prize. His engineering brilliance if not previously known was shown by this single and immense feat of excellence; but unknown to the world-at-large there was much, much more to come in future years. Shortly after this enormous feat of intellectual and technical achievement, two attempts were made by the Nazis to abduct him from Switzerland.

Having being found out he went to the British Embassy to ask for their help. John Argyris told them how he had helped the British with some vital information when in Greece. The embassy contacted Sir Michael Palairet to verify matters and embassy officials were immediately told to create some false papers for John Argyris and to arrange for his safe transport to Britain via Spain and then onto Portugal. Flying from Lisbon to England gave him the greatest of pleasure as John Argyris now knew that his dream to help Britain stop the Nazi war machine was finally at hand.

When he reached Britain at a military air base in England, he was interrogated for three days without relent by two British Intelligence officers who could not believe his story of how he had escaped from Germany and the Nazi regime. They believed that he was a German spy as they constantly asked, ‘how did you hoodwink the Germans for so long?’. Who could blame them for it was a quite extraordinary story. Once the British Intelligence Service was satisfied that John Argyris was perfectly genuine he was attached through Lord Beaverbrook's Ministry of Aircraft Production to the Royal Aeronautical Society (RAeS) who were responsible for giving instructions to the Aviation Industry on how to produce high speed, high mach fighters, among other things. He was installed initially as a technical officer but, due to the RAeS's amazement at his work that no-one at the Society could follow, after a mere few months was promoted to chief technical officer. Indeed, it was agreed and acknowledged at the time that John Argyris was years in advance of any of their engineers. His knowledge and thinking was, to put it mildly, revolutionary. This would inevitably be proved to be the case and was the revolutionary thinking that eventually would lead to the full creation of the 'Finite Element Method’ (the FEM) which was conceived and conceptualised in Britain at the end of the war years, between 1944 and 1945.

When John Argyris's started his work at the RAeS in the early 1940s, 'Data-Sheets' for the design of all civil, military and high speed fighter aircraft were issued to the aircraft manufacturers. However on investigation he found that the methods and those proposed were completely out of date and in many cases had eighty-percent faults in their designs, a point that would indirectly save tens of thousands of Allied lives. As the new chief technical officer at the RAeS John Argyris set about changing all this and single handily brought all the data-sheets up to the high standards necessary for the war effort. But all was not fair sailing though and great difficulties lay ahead as the aircraft manufacturing industry was hard to change to these new, revolutionary and far safer designs. Their reticence was possible due to the decline in profits that realignment to John Argyris's new data-sheets would entail. Indeed, at first they said that what was being asked of them was 'Impossible' and could not possibly be right. Through perseverance, tenacity and sheer grit he stuck to his guns and eventually John Argyris 'showed them the light', with his revolutionary new methods being accepted and adopted by the industry. Indeed, he carried the torch in the aviation industry for revolutionary change. Had he not, Britain would have been at a distinct disadvantage in the air, particularly with D-Day looming.

Over a period of time, eminent people within science and engineering acknowledged John Argyris's supremacy in aeronautical engineering design, notably a very talented scientists who was the senior principal officer of the National Physical Laboratory at Teddington and chairman of the Aeronautical Research Council, a certain Harold Leslie Cox.

After the war others had seen and could see John Argyris's greatness emerging. Sir Arnold Hall who was the senior Professor of Aeronautical Structures at Imperial College asked him to become senior lecturer and then reader within a couple of months. Sir Arnold had seen at first hand with amazement the revolutionary things that John Argyris was doing whilst he was working in the Aeronautics industry. At the Imperial College of the University of London, John Argyris developed fully his 'Finite Element Method', the most advanced mathematical engineering design tool in the world. One has to say at this point that as time would tell, as like Newton and Leibniz with the development of the 'Calculus', John Argyris would have an equivalent person arise in the form of an American to the development of the

FEM. But precedence for Britain and not the United States of America is documented, as John Argyris had started his development of the FEM in the early 1940's, some twenty years before the American equivalent was documented.

John Argyris was made a member of the Aeronautics sub-committee of the Aeronautical Research Council and further advanced their calculations methods and designs. One use of John Argyris's FEM was to determine that the first commercial jet air-liner, The Comet, was unsafe. He predicted that the plane would crash in its present design form. The Establishment of the time in the form of the Ministry of Aircraft Production (Ministry of Supply) were outraged and taken aback by John Argyris's comments. Indeed, they said that he was 'mad'. In support of John Argyris, Sir Arnold Hall told the Ministry to be very careful as he knew John Argyris knew what he was talking about. Indeed, after the second disintegration of a scheduled Comet flight, an American institution approached John Argyris with a view that he would become their expert witness and adviser in a high compensation case through the courts for their clients (relatives of the dead). They said that they were going to make a formal attack on the British aircraft industry. John Argyris refused, despite being offered 5 million German Deutsche Marks by the institution, saying that he could not do this to Britain. A man therefore working for ones adopted country was of paramount importance. How many people today would have done a similar thing? Yes therefore we say, John Argyris was a true patriot of his adopted country, Britain, and that countered for more than anything else.

As John Argyris's great work progressed in bringing the FEM to an extraordinary level of technical advancement, corporations and government departments would seek out John Argyris for help in solving what seemed to them to be insolvable complex problems. Three of these instances concerned the NASA. The first was the dangers of heating-up and design of the mighty Apollo Rockets. This was a tremendous undertaking for which John Argyris was reported for his achievements in the American newspapers. The second was the determination of the stabilising technology for the 1969 moon module and where as with all the NASA projects worked on by John Argyris, they had to be so that the whole 'Mission' could go and come back 'Safely'. Again John Argyris solved the problem which was stopping the launch into space taking place. And thirdly, the re-entry problem for NASA where the space shuttle could quite easily burn-up when re-entering the earth's atmosphere. The determination of the safety of the nose shield was of paramount consideration for NASA. John Argyris undertook the mathematical analysis and design of the nose-cone of the Space Shuttle where the calculations of the high temperatures had to be determined and what their effect would be on the craft. NASA was greatly impressed as one would be and have ever since used the Finite Element Method as their leading design tool. Amongst a multitude of others, is work at the European CERN by John Argyris. Indeed, in respect of the NASA work, even other western governments asked John Argyris for a copy of his groundbreaking analysis and designs, some of the nations clearly not being able to budget for a manned flight to the moon. Other than governments, many large corporations such as Daimler Benz, Boeing and others of similar standing would ask John Argyris for his help. This again usually involved the solution of seemingly insolvable complex problems that they had failed to solve. The Establishment of the time in the form of Sir Alfred Pugsley who was Director of Aircraft Structure at Farnborough, was against the work of John Argyris. He hindered him at every turn of the foot and said that his revolutionary ideas were all nonsense, would never work and cannot be done. After the Comet situation, Sir Alfred accepted that what John Argyris was saying and doing was correct. This cemented the situation with agreeing with him that the FEM was a revolutionary design tool but he made one overriding comment, "*Remember that you are here to obey our orders and not to think for yourself*"! The bureaucratic Establishment at its best and as we of mere mortals are supposed to serve. John Argyris continued to develop the potential of the FEM to a remarkable and astonishing extent.

In Germany, the German Minister of Education had heard of John Argyris and his revolutionary work. He personally came to Britain and was so amazed with what he saw that he said that he would give John Argyris all the necessary resources and finance to set up his own institution in Germany and there carry on his great work.

The German minister told him to formulate plans for the development of such an institution which he believed was a brilliant conception. Britain, typically, could not at the time see the immense potential as they did not understand fully the thinking of John Argyris, it was far in advance of anything at the time. This situation is even present today as over 220,000 web sites either dedicated to the FEM or use its methods continuously can testify. As a matter of interest the number of websites for the FEM (or FEA-Finite Element Analysis) is constantly increasing, as only nine months ago the FEM's websites number just short of 158,000. As the British would not help John Argyris he left for Germany with a heavy heart, for he wanted dearly to stay in his adopted country of choice. Germany could see where Britain could not and another great loss to the UK's future was sealed. These and other issues are the reason why Germany has become the most powerful and dominant economy in Europe today. The only blessing was that John Argyris stayed as professor of Aeronautical Structures at Imperial College of the University of London. Indeed, when John Argyris was known to be going to Germany, the British Government set up a National Agency for the Finite Element Methods and Standards and where WIF member Professor of Aeronautical Structures at Imperial College Glyn Davies has been a Consultant since ever 1983.

The new institution in Stuttgart, Germany, started from nothing but after a short period of time had increased to over thirty highly skilled engineers from England, Europe and the USA. This eventually developed into the leading institution for computer applications in the world. It's services, like today, are in great demand for solving complex phenomena that to many are unsolvable. Indeed, the Chinese were so amazed with John Argyris's work and what he said to them that they made him like many nations, a honorary professor of their leading engineering universities.

With the immense success of the institution, John Argyris started what was to become the world's leading technical journal in Computational Mechanics[4]. Today, with John Argyris as the Journal's Editor-in-Chief, it is served by the world's leading intuitive engineers and where there are over forty publications a year. Conferences for the journal members are held worldwide annually and include the world's leading mathematicians and engineers. John Argyris is still their chairman.

Up to his retirement John Argyris took all the institution's doctoral students under his wing and was the final arbiter if they had reached the doctoral level of the world's leading institution in computational mechanics.

Over the last forty years John Argyris has been honoured by sixteen industrialised nations of the world, many with their highest scientific and engineering honours. Indeed, some have been the Government's personal decorations but not here in Britain. John Argyris was made CBE in the Queen's Birthday Honours in 2000 but this award for all John Argyris's revolutionary work and achievements is little more than what he deserved after the Second World War where indirectly by determining around 80% of faults in our military aircraft saved tens of thousands of military personnel. Indeed, his Finite Element Method has most probably again indirectly saved many thousands of lives through safer buildings and the aeroplanes we travel in each and every day of the year. Therefore, these savings in lives should warrant the highest honour that our nation can bestow. The CBE should have been a start but clearly not the honour worthy of John Argyris and his momentous contribution to engineering sciences throughout the world. In this respect also the FEM is now being used in all the sciences including medicine where, for example, it is used to monitor pressures within respiratory systems. It appears that the FEM therefore will have no scientific boundaries in the 21st century and beyond, and one thing is certain, it will revolutionise the medical disciplines as it has done with engineering. Indeed, as computers become ever more powerful, the Finite Element Method will truly become seen as the equivalent of Newton's Calculus.

John Argyris (†02/04/2004, Stuttgart) is buried in Varberg cemetery, Sweden.

At the ceremony in April of this year, the Greek government accorded him full recognition sending their consul-general and assistant consul-general to bear his coffin. Both Christian and Greek Orthodox services were conducted sequentially. As recognised as the Greek Einstein by the Greek press in 2003 and which won the Greek national prize in journalism, this show of respect was fitting for such a great man of engineering science who literally revolutionised its fundamental base.

The World Innovation Foundation

[4] Computer Methods in Applied Mechanics and Engineering créé en juin 1972 (Editorial de John H. Argyris et William Prager)

Bibliographie sélective[5]

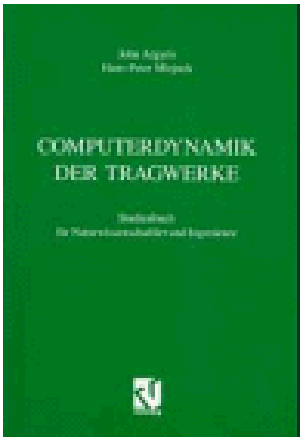
Die Methode der finiten Elemente (1) in der elementaren Strukturmechanik: Verschiebungsmethode in der Statik
John H. Argyris, Hans Peter Mlejnek (*Vieweg* – **1986**)

Die Methode der finiten Elemente (2) in der elementaren Strukturmechanik. Kraft- und gemischte Methoden, Nichtlinearitäten.
John H. Argyris, Hans Peter Mlejnek (*Vieweg* – **1987**)

Die Methode der finiten Elemente in der elementaren Strukturmechanik (3). Einführung in die Dynamik.
John H. Argyris, Hans Peter Mlejnek (Vieweg – **1988**)

Die Erforschung des Chaos. Eine Einführung für Naturwissenschaftler und Ingenieure
John H Argyris, Gunter Faust, Maria Haase (Vieweg – **1994**)

Die Methode der finiten Elemente (3) in der elementaren Strukturmechanik. Computerdynamik der Tragwerke
John H. Argyris, Hans Peter Mlejnek (Vieweg – **1997**)



[5] Nous avons choisi de citer les ouvrages dans leur version originale en allemand. Quelques uns ont été traduits ou adaptés en anglais chez North Holland.