연구실 명

구조해석 및 복합재료 연구실

성명: 하 성 규 / 직위: 교수

Email sungha@hanyang.ac.kr

Tel 02-2220-0420

경력

- 1983 한양대학교 공학학사
- 1985 스탠포드대학교, 공학석사
- 1988 스탠포드대학교, 공학박사
- 1989-1991 스탠포드대학교, 박사후
- 1991-현재 한양대학교, 공학대학 교수
- 2001-2002 스탠포드대학교, 초빙교수
- 2008-현재 스탠포드대학교, 초빙교수

담당과목

- (학부) 고체역학, 응용유한요소
- (대학원) 복합재 역학, 고등구조해석

연구관심분야

- CAE (Ansys, Abaqus, Nastran 등) 시뮬레이션에 기반한 혁신 설계
- 실험과 시뮬레이션을 이용한 복합재료의 구조적 성능 평가
- 복합재 구조물의 재료선정 및 제조공정 개발

구조해석 및 복합재료 연구실	연구실 전화 02-2220-0420	Homepage http://sites.google.com/site/hyucomposites

연구실 소개

● 보유장비

- 필라멘트 와인딩 장비 1대
- 복합재료 제작용 오토클레이브 2대
- 2축 (인장/비틀림) 피로 시험기 8대
- 복합재료 infusion 장비 1set
- 복합재료 제작용 히터 2대
- Universal Test Machine 1대
- DMA 장비 1대
- 충격 시험 장비 1대

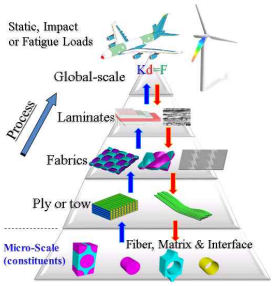
● 연구실 특징

- 20여년간 복합재료 설계, 성능평가 관련 연구 진행
- 다양한 분야의 국내외 산업체와 공동연구 진행
- 멀티스테일 기반 복합재료 구조해석 및 설계
- 복합재료 구조물 피로수명 예측
- 복합재료 구조물 제조 공정 개발
- 자동차 경량화, 풍력발전기 혁신설계, 항공기 복합재료 부품 설계

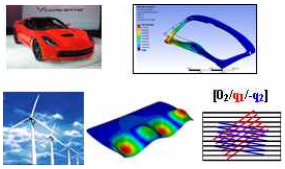
● 주요 연구 논문

- Hayat K, Ha SK. Load mitigation of wind turbine blade by aeroelastic tailoring via unbalanced laminates composites. Composite Structures 2015; 128: 122-133.
- Xu L, Jin CZ, Ha SK. Ultimate strength prediction of braided textile composites using a multi-scale approach. Journal of Composite Materials 2015; 49(4): 477-494.
- Kim SJ, Hayat K, Nasir SU, Ha SK. Design and fabrication of hybrid composite hubs for a multi-rim flywheel energy storage system. Composite Structures 2014; 107: 19-29.
- Ha SK, Hayat K, Xu L. Effect of shallow-angled skins on the structural performance of the large-scale wind turbine blade. Renewable Energy 2014; 71: 100-112.

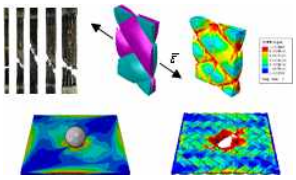
멀티스케일 해석 방법 개발



CAE 기반 구조물 혁신 설계



복합재 구조물의 재료 선정

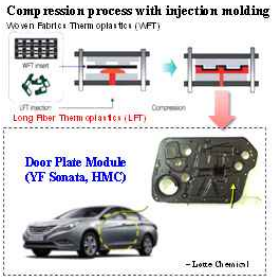


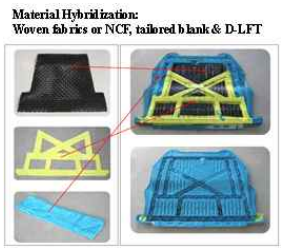
- Huang Y, Jin CZ, Ha SK. Strength prediction of triaxially loaded composites using a progressive damage model based on micromechanics of failure. Journal of Composite Materials 2013;47(6-7):777-792.
- Ha SK, Cimini, CA Jr. Strengths & lives of composites and Stephen Tsai. Journal of Composite Materials 2010;44(20):2345-2346.
- Ha SK, Jin KK, Huang Y. Micro-mechanics of failure (MMF) for continuous fiber reinforced composites. Journal of Composite Materials 2008;42(18):1873-1895.

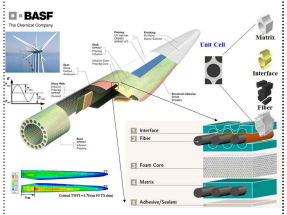
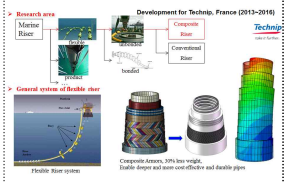
● 주요 특허

- Daniel H. Kim, Thomas A.Afzal, Michael L. Reo, Uriel Hiram Chee, In Haeng Cho, Kunwoo Lee, Curtis W. Frank, Sung Kyu Ha. Prosthetic Intervertebral Disc: America, US 7,905,921 B2. 2011-03-15.
- Daniel H. Kim, Thomas A.Afzal, Michael L. Reo, Uriel Hiram Chee, In Haeng Cho, Kunwoo Lee, Curtis W. Frank, Sung Kyu Ha. Method and a Kit for Inserting Prosthetic Intervertebral Discs into a Spine: America, US 8,038,715 B2. 2011-10-18.
- Daniel H. Kim, Kunwoo Lee, Curtis W. Frank, Sung Kyu Ha. Prosthetic Intervertebral Disc and Methods for Using the Same: America, US 2005/0027364 A1. 2005-02-03.
- Sung Kyu Ha. Composites [carbon fiber] for uranium enrichment using the rotor (rotating speed composite rotor and manufacturing method): Korea, 2013.
- Sung Kyu Ha. Method for the manufacture of flywheel hub (dome type, using the same method and the composite winding flywheel energy storage): Korea, 10-1033108. 2011-04-28.
- Sung Kyu Ha, H.T. Kim, J.H. Kim, H.H. Han, S.Z. Kim, T.H. Seong, Y.H. Han. The hub of the flywheel for energy storage devices (energy storage flywheel rotor dovetail for split-type hub): Korea, 10-0965481. 2010-06-15.

복합재료 구조물의 제조 공정 개발





주요 연구 /프로젝트	● 현대 자동차: 자동차 경량화를 위한 복합재료 개발 - 복합재료 제작 방법 개발 - 차체 최적설계 ● BASF: 복합재료 풍력 블레이드 피로수명 기법 개발 - 에폭시 레진 강도, 피로 거동 평가 - 복합재료 피로수명 예측 기법 개발 - 풍력 블레이드 해석 프로그램 개발 ● Plastic Omnium: 자동차용 복합재료 구조물의 혁신 제작방법 개발 - Sheet Molding Compound (SMC)의 이론모델 개발 - SMC 피로수명 예측 기법 개발 - SMC 해석 프로그램 개발 ● Technip: 해상용 복합재료 파이프의 설계 및 개발 - 복합재료 파이프 최적설계 - 파이프 해석 프로그램 개발 ● Chomarat: 복합재료 직조섬유 (NCF)의 혁신 설계 - 다양한 섬유각도, 직조 방법, 카본섬유와 유리섬유를 고려한 대칭, 비대칭 직조섬유 개발 - 직조섬유 복합재료의 역학적 거동 평가 ● NTU: 브레이드 복합재료의 내구성 평가 - 브레이드 복합재료 강성, 강도 예측 기법 개발 - 브레이드 복합재료 역학적 성능 실험 - 브레이드 복합재료를 적용한 구조물의 해석 및 평가	복합재료 풍력 블레이드 피로수명 기법 개발  해상용 복합재료 파이프 설계 및 개발 

연구실 명(영문)

Ha Structures & Composites Lab (HSCL)

Sung Kyu Ha / Professor
Email sungha@hanyang.ac.kr
Tel 02-2220-0420

Careers

- 2001 Mech. Eng., Ph.D.
- 1996 Mech. Eng., M.S.
- 1995 Mech. Eng., B.S.
- 1983: B.S. in Mechanical Engineering, Hanyang University
- 1985 M.S. in Mechanical Engineering, Stanford University (USA)
- 1988 Ph.D. in Mechanical Engineering, Stanford University (USA)
- 1989-1991 Stanford University Post-Doc.
- 1991-present Professor of Mechanical Engineering, Hanyang University
- 2001-2002 Visiting Professor, Stanford University
- 2008-present Visiting Professor, Stanford University

Subject for Lecturing

- (Undergraduate) Solid mechanics, Finite Element Method (FEM)
- (Graduate) Mechanics of Composite Materials, Advance Structural Analysis

Research Interests

- CAE (ANSYS, Abaqus, Nastran, etc) simulation based Innovative Design
- Structural behavior of Composite Materials (tests and simulations)
- Material selection and Manufacturing Process for Composites

Ha Structures & Composites Lab (HSCL)	Tel 02-2220-0420	Homepage http://sites.google.com/site/hyucomposites

Laboratory

● Equipment

- Filament winding machine 1 set
- Autoclave 2 sets
- Biaxial (tension/torsion) fatigue tester 8 sets
- Composite infusion processor 1 set
- Heater for Composite curing 2 sets
- Universal Test Machine 1 set
- DMA machine 1 set
- Impact drop tester 1 set

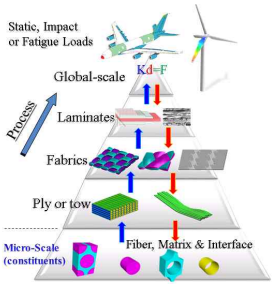
● Laboratory

- Researches on composite materials for over 20 years
- Collaboration with various industrial partners
- Multiscale-based composite analysis and design
- Fatigue life prediction of composite materials
- Development of manufacturing process of composites
- Light-weight automobiles, Innovative blade design, Design of aerospace composite structures

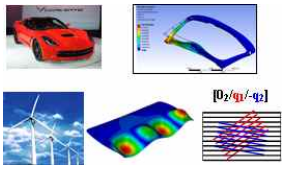
● Main Research Papers

- Hayat K, Ha SK. Load mitigation of wind turbine blade by

Multiscale analysis



CAE simulation based innovative design



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● Main Patent

- Daniel H. Kim, Thomas A.Afzal, Michael L. Reo, Uriel Hiram Chee, In Haeng Cho, Kunwoo Lee, Curtis W. Frank, Sung Kyu Ha. Prosthetic Intervertebral Disc: America, US 7,905,921 B2. 2011-03-15.
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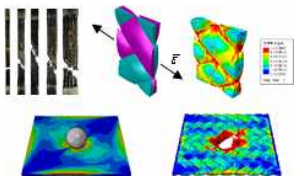
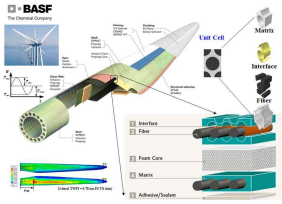
Material selection for composites



Development of manufacturing process for composites

Research /Project	● Hyundai Motor: Development of composite materials for light-weight automobiles - Development of composite manufacturing process - Design optimization of car bodies ● BASF: Fatigue life prediction of composite wind turbine blade - Strength and fatigue behaviour of epoxy resin - Development of composite fatigue life prediction methodology - Tool development for analysis of composite wind blade ● Plastic Omnium: Innovative composites process for automibile - Theory development for Sheet Molding Compound (SMC) - Development of fatigue life prediction of SMC - Tool development for SMC analysis ● Technip: Dvelopment of composite pipes for oil and gas application - Design optimization of composite pipes - ool development for pipe analysis ● Chomarat: Innovative design of Non-Crimp Fabrics (NCF) - Development of various NCFs considering various fiber orientations, stitching patterns, carbon and glass fibers - Evaluation of mechanical behaviors of NCF composites ● NTU: Durability of braided composites - Prediction of stiffness and strength of braided composites - Experiments on braided composites - Analysis of structures of braided composites	Fatigue life prediction of composite wind turbine blade  Development of composite pipes for oil and gas application