

# BSEE Continuous Improvement Program (CIP)

Approved by Curriculum Committee 5/22/14

Approved by the EE Faculty 5/29/14

Approved by Curriculum Committee 3/6/17

Approved by Curriculum Committee 12/5/18

Approved by the ECE Faculty 12/6/18

Revised to include updated PEOs 4/18/19

Approved by the ECE Faculty 5/17/19

## Introduction

This document describes the procedures to periodically assess, evaluate, and improve the important aspects of the BSEE degree program, collectively referred to as the Continuous Improvement Program or CIP. Implicit in this process are the department's desires to provide the best possible undergraduate education to our students, while serving the department's mission and objectives, and to maintain our high standing as one of our nation's elite programs of undergraduate education in electrical engineering. This document describes the specific processes for the periodic review of the program educational objectives (PEOs) and the level that the student outcomes (SOs) are being achieved by its graduates. These review processes are integrated with other regular curriculum review matters which are handled by the Curriculum Committee (CC).

The BSEE program aspects which are managed and reviewed by the Curriculum Committee include

- the program educational objectives (PEOs),
- the achievement level of the student outcomes (SOs) by the program graduates,
- methods used to assess and evaluate student learning,
- the creation, maintenance, and retirement of major concentration areas,
- the sequence of courses and prerequisite chains in the major concentration areas,
- individual course offerings,
- other degree requirements, and
- the continuous improvement program (CIP) itself.

The responsibility for the high-level management and execution of the CIP lies with the ABET Coordinator and the Curriculum Committee (CC). Specific assessment tasks are delegated to instructors and to curriculum group chairs. A number of other assessment surveys are offered to students by the Office of Educational Assessment, the Alumni Office, and the Co-op Office, with voluntary student participation. Each will be described in more detail later.

The continuous improvement program (CIP) is illustrated in Figure 1 below. That portion of the BSEE program curriculum which is under direct control of the ECE department is represented by the three elements of courses, concentrations, and capstones. Each are documented by the Master Course Descriptions (MCDs), by the definition of the concentrations and their

prerequisite structure, and by the capstone principles, respectively. The instructors deliver the curriculum to the students, both of whom participate in various assessment instruments shown below in the large braces.

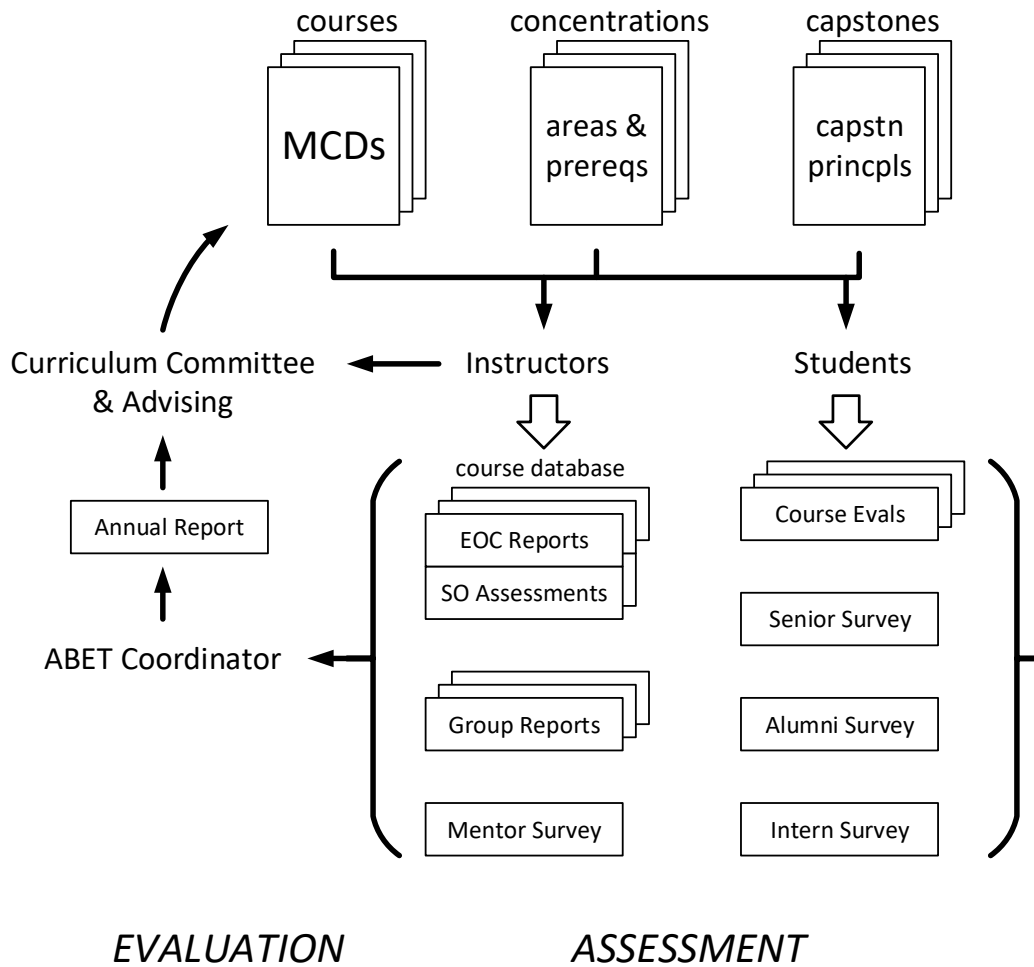


Figure 1. Overview of the Continuous Improvement Program for the BSEE degree.

The specific activities of the CIP are outlined below.

### Daily Activities

On a daily basis, the members of the faculty create course materials and teach the students. The course materials are developed through the research activities of the faculty and the continuous infusion of new ideas and information about new technologies. Minor changes in the presented materials are not documented. Larger changes may be documented in End-of-Course (EOC) reports and Master Course Descriptions (MCDs). The advising office provides an ongoing resource to our students, checking that their course choices and grades comport with program and university graduation requirements.

### Quarterly Activities

Each undergraduate course instructor generates an end-of-course (EOC) report which is submitted through an automated, on-line system. Report data is archived in an ABET database.

In addition, instructors of selected undergraduate courses will include any assigned student outcome assessments as part of their end-of-course report. Instructors are expected to suggest course improvements if any student outcomes are not meeting the levels of competent or exemplary. Students complete course evaluations at the close of each quarter.

### **Yearly Activities**

During Autumn Quarter, the ABET Coordinator briefs the Curriculum Committee on assessment results for student outcomes assessed in the previous academic year. The Curriculum Committee evaluates student outcome achievement against desired achievement, and determines if course improvements at the instructor level have been adequate or whether there is a need for changes at the syllabus or curriculum level to address identified deficiencies in student outcomes. If changes are needed at the syllabus level, the course coordinator is requested to formulate a new course syllabus and Master Course Description (MCD) and present this to the Curriculum Committee for approval. If changes are needed at the overall curriculum level (i.e. issues involving multiple courses and prerequisite structure), the Curriculum Committee will assign the appropriate faculty to develop and present a solution within one year.

The ABET Coordinator determines which student outcomes are to be assessed in the current academic year and makes assessment assignments to instructors of specific courses. To assess students as they near the completion of the program, these assessments focus on capstone and other senior design courses. New or changes to existing capstone design courses are also reviewed for compliance with the capstone design course principles within the Curriculum Committee. The ABET Coordinator is responsible for keeping the program up to date with the currently published ABET program requirements, and shall guide the Curriculum Committee in implementing changes to conform to these current requirements. Such changes are usually implemented within a year when feasible.

In Spring Quarter, the ABET Coordinator organizes several surveys to provide additional program assessment information. A senior survey is offered to graduating seniors which may take the form of either an on-line questionnaire or an in-class interview conducted by experienced staff from the university's *Center for Teaching and Learning* (CTL). An on-line questionnaire is also offered to industry mentors who have helped to supervise senior capstone design projects. The ABET Coordinator compiles all of these survey results into the annual report to the Curriculum Committee. Also during Spring Quarter, each of the undergraduate concentrations (tracks) are reviewed and presented to the Curriculum Committee by the group chairs.

External to the program and department, other campus offices conduct assessments which can also provide useful information to the Continuous Improvement Program. The Office of Educational Assessment conducts annual surveys of the alumni as well as managing the quarterly student course evaluations. The Engineering Career Center manages the internship programs, and conducts surveys of student interns and their supervisors.

### **Activities every 2 – 3 years**

Following the strategic plan of the department, several new professors may join the faculty, bringing new expertise and enthusiasm. The department mission statement and program

educational objectives are reviewed. The Curriculum Committee reviews student outcomes for consistency with these program educational objectives.

## 1. Mission and Constituencies

The mission statement for the Department of Electrical and Computer Engineering currently comprises the following assertions:

- We are committed to a merit-driven diversity for broadening participation in STEM.
- We provide our students with a strong technical foundation, refined communication skills and group project work.
- We hire and retain exceptional faculty to develop an innovation ecosystem.
- We provide electrical and computer hardware fundamentals and promote an entrepreneurial mindset.
- We foster an innovation hub by partnering with industry, government and regional sponsors.

The constituency of the BSEE program includes students (past, present, and future), the faculty of the department, and regional industries who hire graduates of the program and who partner with the department in the pursuit of its mission and program objectives.

## 2. Program Educational Objectives

The program educational objectives (PEOs) of the University of Washington, Seattle, Bachelor of Science in Electrical Engineering (BSEE) degree program are to serve the needs of our students, faculty, and regional industry by producing graduates who have acquired foundational knowledge and skills through a comprehensive curriculum and immersive educational and developmental experience.

After a few years following graduation, we expect our graduates to:

- (A) **Contribute** To have successfully and smoothly transitioned into a contributing member of the professional workforce,
- (B) **Master** To have developed the skills, habits, and professional expertise which will carry them through their life and career,
- (C) **Evolve** To rapidly grow and adapt to their fast changing world,
- (D) **Innovate** To embrace change, challenge, growth, inquiry, creativity, and diversity,
- (E) **Lead** To rise to levels of leadership and impact in their chosen specialties, and
- (F) **Steward** To responsibly apply their problem solving, critical thinking, communication, and management skills to the benefit of themselves, their communities, their region, and the world at large.

The program educational objectives are nominally reviewed every three years, or more frequently as needed. The process for the review and update of the program educational objectives is illustrated in Figure 2.

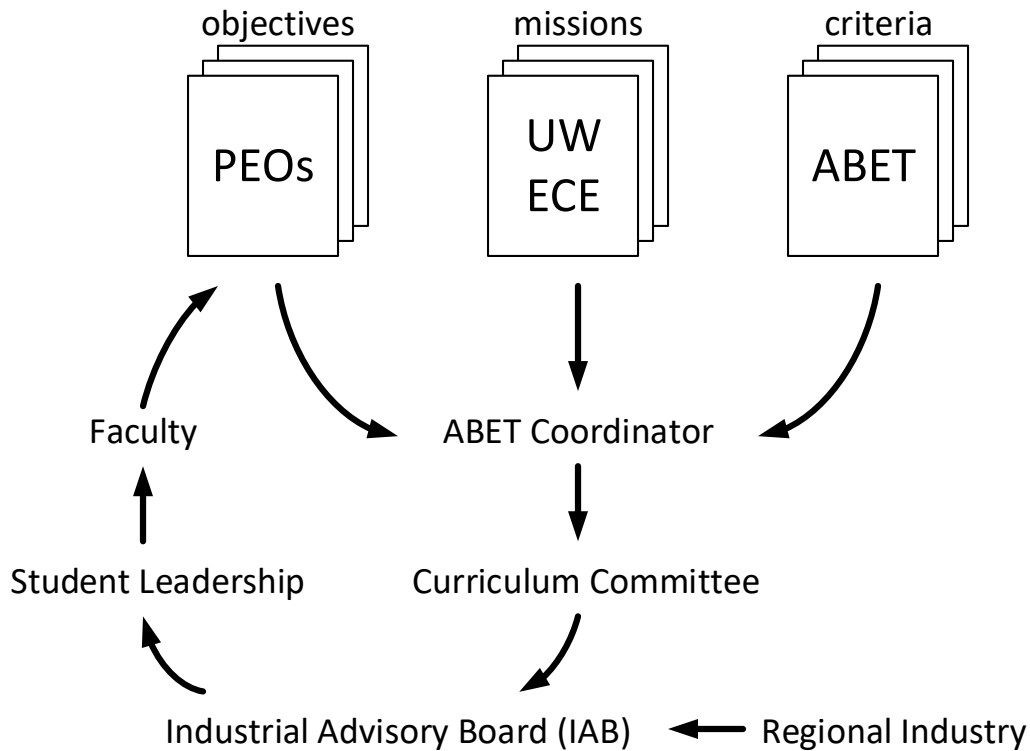


Figure 2. Review process for the program educational objectives.

The ABET Coordinator initiates the PEO review process by summarizing the current PEOs, mission statements, and ABET criteria for the Curriculum Committee (CC), which then suggests changes to the PEOs to better reflect the current status. These changes are reviewed by the Industrial Advisory Board (IAB) who represent the regional industry constituency. Their feedback is incorporated into the new draft, which is then reviewed by the leadership of IEEE student branch and of the Eta Kappa Nu honor society, who represent the student constituency of the program. Their feedback is in turn incorporated into the draft, which is then reviewed by the ECE faculty as a whole, and whose feedback and approval consummates the final version.

### 3. Student Outcomes

By graduation, we expect our graduates to have demonstrated abilities in:

- (1) **Problems** An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- (2) **Design** An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- (3) **Communication** An ability to communicate effectively with a range of audiences

- (4) **Responsibility** An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
- (5) **Teams** An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- (6) **Experiment** An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- (7) **Learning** An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

These student outcomes are the identical language of the current ABET Criterion 3, with the addition of the boldface mnemonics that are used as a shorthand in various review documents.

#### **4. Assessment of Student Learning**

The assessment process is illustrated on the right side of Fig. 1. The assessment instruments used by the CIP are shown within the large braces. Direct assessments of the student outcomes are carried out by instructors and project mentors. Indirect assessments are completed by the students themselves through surveys and evaluations.

##### **Direct Assessments**

Generic rubrics are used to directly assess student outcomes. These generic rubrics are prepared by the ABET Coordinator and categorize student achievement into four levels: novice, developing, competent, and exemplary. Competent and exemplary levels are considered to be meeting achievement expectations, whereas novice and developing are not. The ABET Coordinator shall revise the rubrics as needed to address any changes in the ABET student outcomes and to better measure these outcomes within the scope of the overall program objectives.

Each year, the ABET Coordinator will determine which student outcomes are to be assessed, based upon the planned course offering schedule, the particular outcomes which each course addresses, the course enrollments, and the need for assessing all outcomes across all of the current major concentration areas. To assess students as they near the completion of the program, the assessments focus on capstone and senior design courses. In a few instances, junior level courses may be used to assess an outcome not well represented in the senior offerings. Selected course offerings will have content permitting rubric assessment of the assigned student outcomes. Each course shall maintain an up to date Master Course Description (MCD) which shall explicitly state the relevance of the student outcomes to the material covered in the course, as this will serve as a guide in making the assessment assignments.

In order to capture trends and provide timely feedback to the program, each of the student outcomes will be assessed each academic year. It is desired that at least 25 students be assessed each year for each outcome, with assignments made in proportion to student enrollment in the courses and in the major concentration areas.

Course instructors will perform the student outcome assessments assigned to their course offering using a suitable ABET problem and randomly selected student work. The selected students must be EE undergraduates. The completed student outcome assessment and copies of representative student work upon which the assessment was based will be submitted as part of the end-of-course (EOC) report, which will be due within four weeks after the end of the quarter in which the course is offered.

The ABET Coordinator will organize and invite industry project mentors for the senior design courses to complete a survey which assesses achievement of the student outcomes using the same generic rubrics. These mentor surveys take place at the end of each Spring quarter and are implemented as on-line questionnaires.

The ABET Coordinator will review the EOC reports, student outcome assessments, and mentor surveys and present these results to the Curriculum Committee in the annual report.

### **Indirect Assessments**

Students in every undergraduate class are given the opportunity to evaluate the quality of instruction through the use of instructional assessment surveys distributed by the *Office of Educational Assessment*. These instructional assessment surveys focus on course quality issues, availability of extra help, homework grading and textbook issues, and consequently provide additional useful context around other assessment data.

Each Spring, the ABET Coordinator organizes and invites senior students to participate in a senior survey. These surveys can be either on-line questionnaires or in-class interviews conducted by experienced staff from the *Center for Teaching and Learning*. These surveys ask the students to self-assess their achievement level in the student outcomes, as well as asking some general questions about their demographics, job prospects, and degree satisfaction.

The ABET Coordinator will review the results of the online surveys and transmit the assessment results to the Curriculum Committee in the annual report.

### **Compliance and Process Improvement**

The Advising Office and the ABET Coordinator will jointly maintain records of submission of CIP materials, and report compliance problems to the Curriculum Committee. The ABET Coordinator will report continuing non-compliance to the Department Chair. Faculty compliance with CIP procedures shall be addressed in all yearly faculty merit reviews conducted by the department chair.

Alternative student learning assessment methods will be recommended by the ABET Coordinator and discussed and approved by the Curriculum Committee. As faculty sophistication with assessment methods increases, the methods will be reviewed and improved from time to time. The ABET Coordinator will monitor overall departmental compliance with established assessment procedures and make suggestions for revisions as appropriate.

## **5. Evaluation of Student Learning**

Instructors shall submit an end-of-course (EOC) report within four weeks after the end of the quarter. An on-line form is available for this purpose at

[https://vannevar.ece.uw.edu/cgi-bin/operations/advising/course\\_db/eoq\\_main.pl](https://vannevar.ece.uw.edu/cgi-bin/operations/advising/course_db/eoq_main.pl)

Submission of the report enters the supplied data into a cumulative electronic database. The end-of-course report will address all significant educational and administrative issues that arose during the teaching of the class the previous quarter. Instructors will also comment on the educational outcome achievements of the class. If problems are noted, solutions should be proposed.

The end-of-course report will also contain the results of any assigned student outcome assessments, and these will also be archived within the EOC database. The EOC database is made available to all faculty as an instructional resource and as a tracking instrument of the continuous improvement program. Importantly, the EOC report provides necessary context for properly evaluating the results of the student outcome assessments.

Each Spring, the curriculum group chairs shall each prepare a review document analyzing the ability of each major concentration area (track) within the group to meet student outcome expectations and shall present these results at a curriculum committee meeting. The Curriculum Committee will seek to improve those concentrations for which problems are detected, documenting recommendations, and revisiting the issues as new data becomes available. The Associate Chair for Education will act as group chair for core courses and for courses not presently associated with a particular group (orphan courses). The group chair reports are provided to the ABET Coordinator who will use these as additional information in preparing the annual report.

The ABET Coordinator shall prepare the annual report over Summer and present it to the Curriculum Committee in the Autumn. The report will summarize the assessment results of the past academic year, including EOC reports, specific assigned student outcome assessments, survey results as appropriate, and group chair reports. The Curriculum Committee will evaluate the assessment results within the context of the EOC reports and group chair reports to determine if the level of student outcome achievement is meeting the desired level of expectations and if any addressable issues exist.

If issues are uncovered, these will be addressed through actions at the instructor, syllabus, or curriculum level. Instructor level issues typically involve a single offering of a single course, and the Curriculum Committee may request the instructor to change or improve their methods if they have not already done so on their own accord. Syllabus level issues most commonly involve mis-matched expectations on the workload, proficiency level, or prerequisite background of the students in the course. The Curriculum Committee may request the course coordinator to review the Master Course Description among the instructors of the course and make appropriate revisions. Curriculum level issues involve global aspects of coordination among the courses and instructors, the prerequisite structure within the major concentration areas, the scheduling of course offerings to allow for efficient student progress through the program, the allocation of instructional resources, and the overall shaping of the curriculum to meet the student outcomes. The Curriculum Committee may assign a subcommittee of instructors to address such an issue,



either within a group or across groups, as appropriate. Some issues may require coordination of the Curriculum Committee with other university entities, such as the College Educational Policy (CEP) Committee and the University Faculty Council on Academic Standards (FCAS).

Curriculum Committee actions are recorded in the CC minutes, and tracking of data for purposes of analyzing trends and compliance is recorded in the EOC report database. The EOC database also serves as a resource for instructors who can benefit from the wisdom of past instructors.

## **6. Review of the Continuous Improvement Program**

The department shall maintain the position of ABET Coordinator. An ABET Committee consisting of members of the faculty and representatives of the Advising Office may from time to time be appointed to assist the ABET Coordinator. The ABET Coordinator will assure the smooth running of the Continuous Improvement Program described herein.

The department shall maintain a Curriculum Committee composed of faculty and Advising staff to regularly meet, review, and manage all aspects of the BSEE program. The Curriculum Committee maintains overall authority on the content and requirements of the program.

The ABET Coordinator will be the principal interface between the department and the College of Engineering and between the department and ABET on all accreditation matters. The ABET Coordinator will be responsible for keeping the program up to date with any changes from ABET and integrating such changes into the program.

Each Autumn the ABET Coordinator shall provide an annual report of the state of the Continuous Improvement Program to the Curriculum Committee and the Department Chair noting the educational assessment results, valuable comments and suggestions gleaned from student surveys, the improvements in the undergraduate educational program that occurred since the previous report, the problems that were discovered during the course of the academic year and referred to the ABET Coordinator, as well as an analysis of all major changes instituted in courses, curricula and assessment methods. The report may also include updated schedules for review of the program educational objectives by the department and its constituencies.

Every third year, or more frequently as required, the ABET Coordinator will conduct a comprehensive review of the Continuous Improvement Program and recommend changes to the Curriculum Committee, and then to the faculty, if deemed advisable.

## 7. Schedule of Activities

The following table highlights the activities described above, showing their frequency and the party responsible for initiating the activity.

<b>Activity</b>	<b>Frequency</b>	<b>Responsible Party</b>
Assign outcome assessments to selected classes	Quarterly	ABET Coord
Conduct assigned outcome assessments in selected classes	Quarterly	Instructors
Submit end-of-course (EOC) reports	Quarterly	Instructors
Update the CIP to conform to current ABET requirements	Yearly	ABET Coord
Review assessment data, performance criteria, and assessment practices	Yearly	ABET Coord
Organize and distribute senior survey	Yearly	ABET Coord
Organize and distribute mentor survey	Yearly	ABET Coord
Review courses and coordination with each curriculum group; report on student outcome coverage of concentration areas	Yearly	Group Chairs
Present annual ABET report to Curriculum Committee	Yearly	ABET Coord
Evaluate assessment results and other EOC data	Yearly	Curric Comm
Review alumni surveys	Yearly	ABET Coord
Initiate review of program educational objectives	2-3 years	ABET Coord
Review department mission statement and PEOs	2-3 years	Faculty

## Change History

April 12, 2007	Originally approved by vote of the EE faculty.
October 28, 2008	Modified by addition of outcome (n)
June 15, 2013	Modified with revised Mission Statement.
December 5, 2013	Change History Section created. Figure 1 incorporated. Outcomes (l), (m) and (n) removed, no longer required by ABET. Assessment of Program Educational Objectives removed, no longer required by ABET. Revised Program Educational Objectives incorporated.
May 28, 2014	Minor process changes to reflect current practice. Major modification of assessment process to focus on program assessment. Minor textual revisions.
March 6, 2017	Revised end-of-course (EOC) reports to include assigned student outcome assessments. Revised student outcome evaluation strategy into three levels: instructor, syllabus, and curriculum. Elimination of non-functioning task forces. Approved development of automated on-line EOC reporting system and ABET database.
December 6, 2018	Revised to reflect the 2016 department mission and objectives statement. Revised to reflect the new ABET Criterion 3 student outcomes. Revised to reflect the new program educational objectives (PEOs). Revised to include both in-class CTL group discussion and on-line capstone student senior surveys. Revised the assessment cycle from a three-year rotation to cover all outcomes each year. Language adjustments to properly distinguish the program from the department and evaluation from assessment.
April 18, 2019	Revised to include newly adopted PEOs.
May 11, 2019	Revised to include the most recent department mission statement. Revised to include the capstone mentor survey as a regular assessment. Revised to include updated figures for the CIP processes. Rewritten to discuss the assessment methods and their frequency in the same place. New document formatting, updated Figs. 1 and 2.